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RAILWAY
MECHANICAL ENGINEER

General Overhaul of the

New Haven Comet

One of the three units of the Comet at Van Nest Shop

By P. H. Hatch*

The first general overhaul of the three-car Diesel-electric train at the end of three years of service, during which time it ran 405,000 miles, reveals many interesting facts concerning the operation of power plants and auxiliaries

In a previous article appearing in the January, 1937, issue of *Railway Mechanical Engineer,* the results of the first year of operation of the New Haven Comet were described. The train has now passed its three-year mark and on November 1, 1938, was released from its first general overhaul after making 405,000 miles in service. In the course of this work the train was almost entirely dismantled, so that an excellent opportunity was afforded for detailed inspection of the equipment, as a result of which many interesting and in some cases unsuspected facts and conditions were brought to light.

Since the type of service operated has a direct bearing on equipment performance, the results of the general overhaul were additionally significant by reason of the fact that during the preceding nine months the duty imposed on the Comet was the severest in its history.

Due to the re-arrangement of service in the Boston-Providence territory in September, 1937, several steam trains were discontinued and The Comet's schedule was altered to provide substitute and in some cases additional service. This has resulted in increased patronage for the train, but has involved operating it in what might be called "local express" service for a majority of its trips. At the present time only two of the 10 single trips week-days between Boston and Providence involve the old schedule of 44 minutes for a 44-mile run including two intermediate stops; two other trips involve a total of three intermediate stops with schedule lengthened to 48 minutes; the remainder involve five stops with a 55-minute schedule. On Sundays four round trips or eight single trips with five stops and a 55-minute schedule are operated. Special Sunday excursions have been eliminated, and The Comet is now in regular operation both week-days and Sundays.

It can readily be appreciated that the assignment of a train designed for high-speed operation to local express runs with frequent stops imposes a greatly increased duty on its motive power equipment. This has been reflected in increased fuel consumption and decreased brake-shoe and wheel mileage as well as in less tangible factors.

The ordinary maintenance of the train is handled at Boston at night. A special force has been organized and is assigned exclusively to the Comet work. Weekly inspections are performed progressively throughout the week; monthly and I. C. C. inspections are handled as a unit one day a month, the train being taken out of service for this purpose.

Due both to the desirability of a complete check-up of the condition of the train as well as to the actual state of the Diesel engines after $3\frac{1}{4}$ years of operation and 405,000 miles, a general overhaul was scheduled for the summer of 1938. Van Nest shop (New York City), the central point for repairs to main-line electric locomotives

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The parts of the two Diesel engines of the Comet were completely dismantled—These, together with some truck parts, are shown in the shop while undergoing repairs

and multiple-unit cars, as well as Diesel-electric switching locomotives, was selected as the logical place for the Comet general overhaul and accordingly, on July 3, 1938, the train was moved under its own power to that shop.

Preparations for the General Overhaul

Several months previous to the actual shopping, the groundwork for the overhaul was laid. It was known in advance that certain work would be necessary; conferences were held with the local forces to develop additional items, supplemented by actual inspections of different parts of the train. From these various sources it was possible to make up a comprehensive work schedule and requisition the necessary material.

The unknown quantities, of course, were what conditions would be found when the equipment was dismantled and what material would then be required. It was on this account, therefore, that efforts were directed toward as prompt and systematic disassembly of apparatus as possible.

While the shop forces were in most cases familiar with the different kinds of work required, they were totally unfamiliar with the particular details of the work peculiar to the Comet. For example, there was in general nothing new about the truck work; specifically, however, there were the shock-absorber units of the trucks which required entirely new and unfamiliar treatment. The same was true of Diesel engines, electrical control, heating boiler, and so on.

Hence when the schedule of general overhaul items was completed, a meeting was held with those who were to assist in general supervision, and each man was assigned those items in his particular field. Similar assignments were subsequently made to the shop supervisors who were at the same time informed to whom to look for general supervision in carrying out various classes of work. This procedure was of great assistance in overcoming the general obstacle of unfamiliarity.

The General Overhaul

The general overhaul work got under way on July 5. The first main activity undertaken was separating the three cars and placing them on dummy trucks to facilitate their movement about the shop. This was the first time since the train was built that this was done and it afforded an opportunity to inspect the articulation connections. Engine-room hatches were lifted off and Diesel engines, electrical equipment, air compressors, battery, heating boiler, etc., were removed. Seats and interior fittings were removed from the car bodies. In other words, nearly all important items of equipment were taken out and sent to the respective departments in the shop for attention.

Under the following headings is given an outline of the work involved on various major parts of the train or its equipment.

Diesel Engines*

The largest single item of work on the Diesel engines was the reconditioning of crankshaft journals and pins. After some investigation a local company was found which had grinding equipment suitable for the shafts in question and which furthermore had had extensive experience in such work, and after removal both crankshafts were boxed and shipped to this company. Table I shows the diameters of individual crankshaft journals and pins of both engines before reconditioning and Table II the clearances at the pins and main bearings.

The pins and main journals of the No. 1 engine crankshaft were both ground .025 inch undersize; the pins of the No. 2 engine crankshaft were ground .025 inch undersize and the main journals .035 inch undersize.

It is believed that on completion of the work the crankshafts were fully as accurate as when new.

Table III gives the clearances as found at the crankpins and main bearings of the two engines.

The main bearings, particularly in the No. 2 engine, were found to be in need of replacement. The crankpin bearings, on the other hand, came through the 3¼ years in excellent condition in both engines.

The new undersize main bearings purchased were lined with a special soft babbitt in accordance with the manufacturer's latest design. The new undersize crankpin bearings were lined with the same grade of babbitt as formerly. Special arrangements were made for boring both main and crankpin bearings to size. For the former a boring bar was made up, and a vertical milling machine, formerly used for milling slots in the stators of single phase motors used in the original New Haven electric passenger locomotives, was adapted for use with it.

* The Comet is equipped with two Westinghouse six-cylinder, four-cycle Diesel engines developing 400 hp. at 900 r. p. m. The cylinder size is 9 in. by 12 in. A complete description of the train appeared in the *Railway Mechanical Engineer* for May 1935, page 185.

This made an excellent combination and produced very satisfactory results.

For boring the crankpin bearings, a jig was made to hold the connecting rod with the bearing so that each one could be bored to the same dimension from center of the piston pin bushing to the center of the bearing, thus maintaining the correct stroke throughout.

completely dismantled and new parts installed as dictated by amount of wear found. A new ball thrust bearing arrangement was applied to the timing-governor spline shaft on account of frequent failures of the old type bearing.

New high-pressure fuel-injection pumps were installed at the previous annual repair shopping, and hence beyond

Table I — Crank Pin Measurements

Crank Pin Diameters, Inches

Crank Pin No.	No. 1 Engine 1	2	3	4	5	6	No. 2 Engine 1	2	3	4	5	6
Front Vertical	4.996	4.9955	4.9965	4.995	4.994	4.995	4.992	4.993	4.9925	4.995	4.991	4.994
Front Horiz.	4.997	4.998	4.9975	4.998	4.996	4.9975	4.997	4.996	4.9945	4.997	4.997	4.994
Rear Vertical	4.996	4.9965	4.9965	4.9955	4.994	4.996	4.994	4.991	4.994	4.9935	4.9895	4.9935
Rear Horiz.	4.9975	4.9985	4.9985	4.9975	4.9965	4.998	4.996	4.997	4.995	4.9965	4.997	4.9945
Initial (actual)	4.999	4.999	4.999	4.999	4.999	4.999	4.999	4.9995	4.9995	4.999	4.9995	4.999

No. 1 Engine: Maximum diametral wear, .005 in.; Maximum out-of-round, .003 in.

No. 2 Engine: Maximum diametral wear, .010 in.; Maximum out-of-round, .0075 in.

Table II — Main Bearing Measurements

Main Bearing Journal Diameters, Inches

Bearing No.	No. 1 Engine 1	2	3	4	5	6	7	No. 2 Engine 1	2	3	4	5	6	7
Front Vertical	4.9965	4.9965	4.997	4.9935	4.997	4.997	4.996	4.999	4.996	4.991	4.988	4.993	4.995	4.999
Front Horiz.	4.9985	4.997	4.996	4.998	4.996	4.995	4.997	4.998	4.9965	4.996	4.9995	4.997	4.9955	4.997
Rear Vertical	4.996	4.9965	4.9945	4.995	4.996	4.996	4.996	4.998	4.997	4.9895	4.9905	4.994	4.9955	4.997
Rear Horiz.	4.998	4.9985	4.998	1.998	4.996	4.9965	4.9965	4.9905	4.997	4.997	4.998	4.9965	4.997	4.9965
Initial (nominal)	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000

No. 1 Engine: Maximum diametral wear, .0065 in.; Maximum out-of-round, .0045 in.

No. 2 Engine: Maximum diametral wear, .012 in.; Maximum out-of-round, 0.115 in.

Table III — Bearing Clearances

	No. 1 Engine 1	2	3	4	5	6	7	No. 2 Engine 1	2	3	4	5	6	7
Crankpin (on top center)	.005	.005	.003	.007	.007	.008	...	.005	.004	.008	.008	.006	.009	...
Main (maximum)	.012	.015	.013	.022	.012	.013	.015	.019	.0125	*	*	*	.012	.011

* Defective babbitt prevented taking correct measurement.
Note: Dimensions given are in inches.

When being assembled for boring, all bearings were set up with proper thickness of shims.

Due to weakness in design of the original type cylinder liners, they had been replaced with new design liners with a nominal bore of 8⅞ inches instead of the original bore of 9 inches. Likewise pistons with the so-called dish tops had replaced the old type pistons and turbulence rings. These changes having been made within a year or so, nothing of any special significance was developed by the overhaul regarding liner and piston life except the general conclusion that liner wear appeared to be satisfactory with the piston-ring arrangement used. The latter has been changed and it is expected that improvement both in wear and lubricating-oil consumption will result. In brief, this arrangement consists of tapered compression rings with bronze inserts in the two top grooves, plain tapered compression rings in the next three grooves, and oilcutter rings in the two bottom grooves.

The principal cylinder-head activities consisted of the renewal of rocker-arm bushings and valve guides, grinding of valves and resurfacing of valve seats. The decompression lever arrangement on the engines was discontinued.

Camshafts were removed and inspected and found to be in good condition with very little cam wear. Camshaft bearings were in good shape.

Gear-train back lash was encountered in both engines, but after renewal of worn bushings it was reduced to such an extent that it is expected the present gears can be continued in service until the next general overhaul.

The hydraulic governors and timing governors were a thorough checking of drive, control, eccentrics, connecting rods, by-pass valves and check valves the assemblies were not disturbed. At the conclusion of the repairs, of course, all pumps were set and adjusted for correct start and duration of injection. Nozzles were cleaned, tested and adjusted as necessary.

All water and lubricating-oil radiators were removed, tested and thoroughly cleaned. They were found to be in generally good condition with the exception of a few easily repaired leaks. Lubricating oil piping, in particular, was cleaned by pumping a special hot solution through it to remove the carbon coating on the interior.

Lubricating-oil gear pumps were removed and new gears and other parts installed. A new impeller, shaft and packing were installed in the No. 1 engine water pump; a new shaft and packing in the No. 2 engine pump.

In order to correct somewhat excessive corrosion in spots in the water spaces of the engines, the water treatment previously used was intensified and the spots were filled in with compound.

The exhaust-manifold muffler on the No. 1 engine had been fitted with a sheet metal housing arranged to be ventilated by the ejective action of the exhaust gases. This was applied two years ago in the attempt to reduce the temperature of the engine room and of the battery electrolyte. While the battery temperature has since been materially reduced by other means, nevertheless tests showed that the muffler housing had actually reduced the engine-room temperature somewhat, and it was thought that by keeping a more constant temperature on the muffler itself, expansion with consequent cracking had

also been reduced. Hence during the general overhaul, a similar housing was applied to the exhaust-manifold muffler of the No. 2 engine.

Previously the crankcase breather pipe on both engines was led directly to the outside under the train. This made one more source of oil drip underneath and in case of any visible vapors made an unsightly appearance at stations. During the general overhaul this was corrected by leading the breather into the air intake manifold on each engine.

Another improvement was the installation of separate drain lines into the fuel tank at each end for low-pressure regulating valve spillover and high-pressure nozzle spillover. The previous arrangement resulted in undesirable oil leaks and dilution.

Electrical Equipment

The main and auxiliary generators were removed for commutator turning, cleaning and painting of the armatures, fields and leads and dismantling and inspection of bearings. The No. 1 main generator ball bearing

The "whirled" finish on the sides being put on with an air tool

was renewed because of the condition of the outer race.

All traction motors, including the spare, had gone through the shop within a year for commutator turning and installation of roller armature bearings. Hence at the overhaul, it was necessary only to clean and inspect them and to check the bearings.

Radiator fan motors, air compressor motors and Freon compressor motors were removed for general attention including turning of commutators.

Small auxiliary motors for evaporator fans, exhaust fans, fuel transfer pumps, boiler-water pump, boiler burner and boiler oil pump were removed and overhauled, as was the boiler-control ac-dc motor generator set.

Relays were removed, overhauled, tested and adjusted, as were contactors, unit switches and reversers. Master controllers were inspected in place.

Some wiring was renewed, principally on account of deteriorated insulation due to being subjected to external heat, such as engineroom lighting wiring, resistor connections and wiring for throttle operators, trips, etc., on the engines. Oil-soaked leads were cleaned and general attention was given as required to all exposed wiring and cable in the way of renewal of insulation, cording and protection against chafing.

Storage Battery

On test discharge the battery was found to have approximately 85 per cent of rated capacity. Internal inspection of some cells, however, indicated the need for special treatment if another year's service were to be obtained. Hence the 56 cells were sent to the manufacturer's service station where the necessary attention was given them. This included the renewal of six cells of very low capacity with used cells in good condition after which slightly over 100 per cent capacity was obtained on test discharge. Thus it is believed that satisfactory service will be obtained for the next year although it will probably be necessary to purchase a new battery at the next annual repairs to the train.

Mention has already been made in this and the previous article on The Comet of the unsatisfactory battery conditions which were found to exist. These were first laid to high engine-room temperatures, but a subsequent thorough investigation and analysis showed conclusively that lack of proper control of charging rates was mainly responsible. This has been remedied by the installation of voltage regulators to hold charging voltages at idling to its proper value. Hence, while as mentioned previously, it will no doubt be necessary to renew the entire battery next year after a life of almost 4½ years, it is expected that the new battery will have a much better chance to realize a long life in Comet service.

Speedometer

The experience with the speedometer equipment had been rather unsatisfactory. Lack of permanency of adjustment and inconsistency of indication were the principal troubles. Accordingly the speedometer was returned to the plant of the manufacturer for checking and repairs, the latter including modernization in certain important respects. Experience in service so far shows considerable improvement.

Air Brake Equipment

All major items of the air brake equipment were removed for repairs and testing. Both Decelakrons were inspected and adjusted for proper deceleration settings. Necessary minor repairs were made to the air compressors.

Doors and Door Control

Opportunity was afforded for thorough inspection of door engines and door- and step-operating mechanisms. Cup leathers were renewed and bleeder cocks ground in. New and larger pins were installed in the levers, and magnet valves, interlocks, indicating lights, switches, etc., were inspected. Leads to the outside door switches from junction boxes under the floor were renewed.

The train was originally equipped with rubber step treadles with a contact-making arrangement so connected that a door could not be closed with anyone standing on the folding steps or if a door were starting to close, any weight on the treadles would immediately open the door and let down the steps. Because of difficulty in keeping them waterproof, however, and operating on a relatively high voltage for door-control circuits, these treadles frequently grounded and occasionally set up false circuits which were extremely troublesome. For instance, while the train was in motion a door and steps might open

which would stop the train, but in some cases not before the steps had fouled an intertrack fence, dwarf signal or some similar wayside object. Furthermore, since the door circuits were connected to the main control circuits of the entire train, it was highly undesirable to have any grounds whatever in any part of the system. Hence in view of the fact that other and more effective safety devices were already in service, it was decided to disconnect the door treadles entirely. This had been done some time previously, but at the general overhaul the old rubber treadles were replaced by aluminum step treads with suitable anti-slip pattern. These are much neater in appearance, and should outlast the former treadles with less maintenance.

The passenger-compartment door checks had given considerable trouble with wear of the bolts used to hold the doors in the open position. These checks were renewed and changes were made by the manufacturer which have definitely improved their operation.

Air-Conditioning Apparatus

Except for the completion of the relocation of fluid control valves in the car vestibules to make them more accessible, only routine attention was given for the most part to the air conditioning apparatus.

Boiler and Control

The heating boiler was removed and given general repairs. A new and improved firebox was installed.

The automatic control equipment for the boiler was inspected and repaired. The motor-generator set was moved to a more suitable location away from the fire door.

Steam train-line expansion joints were repacked and regulators were dismantled, repaired and adjusted.

Truck Repairs

Both motor and articulation trucks were completely dismantled. Motor-truck wheels had been renewed late in the previous spring and at the general overhaul the contours were restored; articulation truck wheels were renewed. All roller bearings were removed and inspected by manufacturers' representatives.

The center-plate assembly in the motor trucks was of special design and made use of rubber units and plates of special material. Experience in service was not very satisfactory and it was replaced with a more conventional arrangement which gave much better results. Articulation-truck center plates were of generally similar construction and these were modified at the general overhaul.

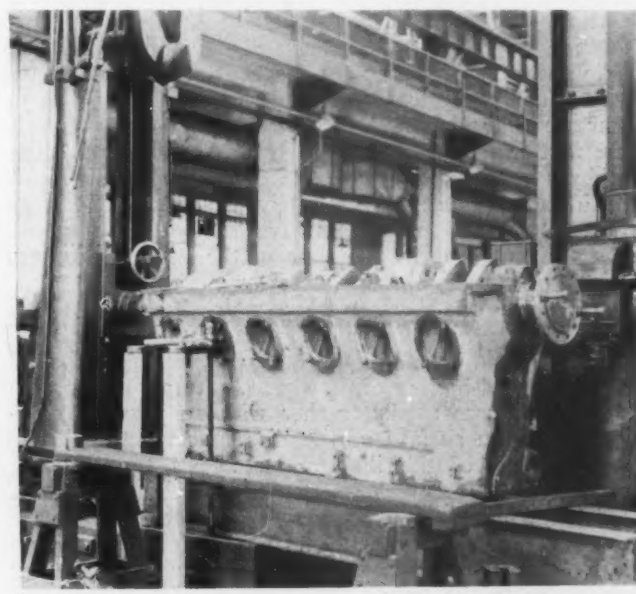
Repairs were made to the motor nose supports, wear plates were renewed as necessary, brake rigging and other pins and bushings were replaced and other truck maintenance of a routine nature was attended to. Motor-axle bearings were rebabbitted. Four new design slack-adjuster engines were installed for test, one on each truck.

Probably the center of interest in the Comet trucks is the shock absorbers. Each of these, it will be recalled, is fastened at the top to the truck frame and at the bottom to one end of the equalizer supporting the truck bolster. They hang at an unusually wide outward angle compared to the conventional bolster hangers. The shock absorbers themselves are the same type as used for airplane landing gear. In brief they consist of an inner and outer coil spring with hydraulic damping. The fluid used is a half-and-half solution of alcohol and castor oil, the former being added to obtain fluidity in cold weather.

After the second year of service, the shock absorbers were returned to the manufacturer for inspection and repairs. Many of their parts were found to be in such condition that annual dismantling and inspection was decided upon thenceforth.

Accordingly the railroad made up the necessary tools for this and at the general overhaul the eight motor truck and eight articulation truck absorbers were disassembled. All of the main springs were found to be in excellent condition. The top spring retainers, however, had rubbed against the ground portion of the piston rods to such an extent that eight rods required building up to their original diameter in order to maintain the effectiveness of the leather packing preventing loss of fluid. Chromium plating was resorted to for this restoration. Most of the wear had taken place on the top sides of the rods due to the angle of suspension of the absorbers.

Various means of eliminating this wear were studied since the need for building up was becoming an annual occurrence and would eventually mean the scrapping of the rods, to say nothing of the expense and trouble encountered each year. Spring retainers made of high-tensile aluminum bronze were eventually decided upon



Line-boring the main bearings of one of the Diesel engines

and manufactured, the design being changed so that the surface in contact with the rods provided as great a bearing area as possible. Experience in service with the new type retainers will be watched with great interest.

The Superstructure

Car Bodies

The Comet is essentially an aluminum train. With the separation of the cars and the removal of equipment incident to the general overhaul, a careful check was made to determine if corrosion of any aluminum parts had occurred. Only a few instances were found and these in relatively unimportant locations, so that the train was given a clean bill of health in this regard. The spots in question were treated with a special corrosion-resistant paint for aluminum recommended by the manufacturer.

The condition of the interior finish of the cars between the windows and floor and on some of the bulkheads made it necessary to replace it during the overhaul. The basic cause of the trouble was moisture, either from natural sweating or steam leaks, or both, the result being a blistered and spotted surface here and there,

with numerous holes punched through. The removal of the finish provided an opportunity to check the condition of the aluminum foil insulation which was found to be excellent.

New rubber flooring was applied to the aisle of the center car, and other rubber flooring was repaired as necessary. New rubber mats were installed in the vestibules.

Painting and Exterior Finish

The Comet was completely repainted inside and out. Except for the so-called "whirled" finish of the aluminum sheets on the outside no particular problems were encountered.

When the train was built, the surfaces corresponding to the letter board on conventional cars and the side sheets under the windows were left in natural aluminum color. To heighten the effect these surfaces were given a whirled finish consisting of overlapping circles, which, when varnished and waxed, presented a striking and at the same time pleasing appearance. This finish, however, has been very difficult to maintain, the reason being that the protective varnish and wax coating has worn through in places, particularly where subjected to the action of snow and rain at high speeds or constant wiping where fuel or lubricating oil spilling has occurred at or near the filling points. An aluminum surface, particularly one that has been roughened by the whirling process, oxidizes very readily, with the result that the whirled finish had disappeared completely in spots. At various times in the past these spots have been patched up with new whirling, but by the time of the general overhaul considerable attention was necessary.

All of the side sheets were re-whirled, and for this a guide for the whirling tool was made up and arranged so that it could be slid along the surface on tracks bolted to the top and bottom of the sheets. An air motor with a fibre disc was used, together with an abrasive compound for the surface of the disc in contact with the sheets. One of the illustrations shows the whirling process under progress on one of the cars. While a fairly neat job could be done in this manner, it was very expensive and was not equal to the original finish which was given to individual flat aluminum sheets before application to the train.

Water Storage Tanks

Diesel-engine sub-base, water, fuel-oil and lubricating-oil storage tanks and car structure beneath the engine room are all combined into an integral, built up bed plate at each end of the train. In the No. 1 end, the water tank is used for service water which is pumped to the saloons; in the No. 2 end, it is used for boiler feed water.

Almost from the time the train was first put into service there were complaints of discolored water in the wash bowls. The bed-plate tank was frequently flushed and cleaned, but the discoloration persisted. One of the principal items in the general overhaul schedule was the investigation of both water tanks with the object of eliminating the corrosion which obviously must be taking place.

When the Diesel-engine generator sets were removed, therefore, both tanks were thoroughly inspected. Sufficient evidences of corrosion were found to make it absolutely necessary to arrest it immediately since otherwise weakening of the train structures in both ends would ultimately result, aside from continued trouble with rusty service water from the tank at No. 1 end.

Whereas it was practicable to treat the boiler feed water in the No. 2 end tank for absorption of free or dissolved oxygen, using conventional methods and materials, the addition of any chemicals to service water was definitely undesirable. Hence, after considerable investigation, it was decided to install an overhead service water tank of copper for the two saloons in the end of each motor car, the water to be fed by gravity which would permit the discontinuance of the electrically driven service water pump and water line through the train. Under these conditions, the bedplate tank formerly used for service water was cleaned, its interior was coated with fuel oil and it was permanently sealed up.

To protect the bedplate tank used for boiler water, arrangements were made for intensive treatment along the lines described. To assist in thorough cleaning prior to this, as well as in the future, a number of additional hand holes were cut in the top of this tank.

Miscellaneous

Additional drains, connected to the original drain pipes were installed in the wells under each generator.

Additional drainage holes were installed in the "underskin" of the train.

Threshhold plates at articulation connections were renewed and revised method of securing applied.

Testing

To provide convenient, inexpensive and accurate means for testing and adjusting Diesel-electric equipment at Van Nest shop, a water rheostat had been built with ample continuous capacity for any of the equipments in service. This was utilized for testing the Comet and proved its worth many times over. It would have been almost impossible to have done the work adequately without it. The number of road tests that would have been required to obtain the same variety of loads easily and quickly available by means of the water rheostat would have been prohibitive in both expense and time. As it was, only one road test was required and this for the purpose of testing general operation of the train as a whole.

In conjunction with the loading provided by the water rheostat, pyrometer equipment for measuring exhaust gas temperatures and a maximum-pressure indicator for determining cylinder pressures were utilized to check conditions in each cylinder of the Diesel engines and to balance them as necessary.

In brief, the testing procedure for each engine included a careful adjustment of high-pressure fuel pumps for correct timing and duration of injection. After prolonged running-in of both engines, the hydraulic governors were adjusted for correct engine speeds, after which the electrical governors, or speed-control apparatus, were set for proper engine loading in the running notches.

At the conclusion of the tests, the operation of the engines appeared to be exceptionally smooth. Plenty of power was available in each, the fuel stops being adjusted to limit the output to rated value. Exhaust conditions were better than ever, and lubricating-oil and water temperatures were well within the proper ranges.

During and in between the Diesel engine testing, the boiler and train-heating equipment were tried out, as were the door and step operating mechanisms and control, air-conditioning and ventilating equipment, lighting, etc. The testing of the air-brake system had been for the most part completed.

Before the final release of the train, a road test was arranged for the purpose of checking trucks, bearings and riding qualities. During the test, 155 miles were run at speeds starting around 15 m. p. h. and being progressively increased to a maximum of 87. Performance, with the exception of two or three instances of a

(*Continued on page 61*)

Santa Fe Locomotives

Baldwin builds 21 units, eleven 4-8-4 type for passenger service and ten 2-10-4 type for freight—Interchangeability of parts a feature of the designs

DURING the year just past, the Atchison, Topeka & Santa Fe added 27 locomotives to its motive power inventory which were built by the Baldwin Locomotive Works. Seventeen of the units were for passenger service, six of the 4-6-4 type* and eleven of the 4-8-4 type, and ten were large 2-10-4 type freight locomotives.

Passenger Locomotives

The eleven 4-8-4 type passenger locomotives were built for service between La Junta, Colo., and Los Angeles, Cal., where, in the mountain territory west of La Junta, grades of 3½ per cent are encountered. These locomotives which are all oil-burners, have a tractive force of 66,000 lb., weigh 286,890 lb. on drivers and have tender capacity for 20,000 gal. of water and 7,000 gal. of fuel oil.

The boilers of all eleven locomotives have nickel-steel shell-course plates. Ten of the locomotives have inside firebox sheets of carbon steel, while on the eleventh unit they are nickel steel. The inside diameter of the first course is 88¼ in. The fireboxes on these locomotives are exceptionally large, being 108 in. wide and 144 in. long inside. Combustion chambers 64-in. long are included in the design. Three Thermic syphons are installed in the firebox and one in the combustion chamber. An extensive application of flexible stays is used in the firebox and combustion chamber. Welding has been utilized in numerous locations in the fireboxes. The boilers are equipped with Elesco Type E superheaters with American multiple throttles. Worthington feedwater heaters are mounted in front of the stacks. The locomotives are equipped with Booth burners for the use of oil as fuel but are so designed that they may be changed over to burn coal.

A one-piece cast steel bed furnished by the General Steel Castings Corporation forms the foundation. The running gear consists of four-wheel engine trucks with 37-in. wheels, 80-in. drivers with Baldwin disc-type cast steel centers, and four-wheel trailer trucks having 40-in. wheels. Timken roller bearings are used on all truck and driving wheels. The front drivers are equipped with the Franklin lateral motion device. The guides are of the Laird type. The main and side rods are heat-treated, chrome-nickel-molybdenum steel. Tandem main rods are connected to the second and third drivers. The valve motion is of the Walschaert type with 60 per cent maximum cut-off, and is controlled by a Baldwin reverse gear. Mechanical lubrication is used extensively, three force-feed lubricators comprising the equipment of each unit.

Other equipment on these locomotives consists of Westinghouse No. 8 ET brakes with one 8½-in. cross-compound compressor; Viloco sanders and operating valves, 14-in. Pyle-National headlights with Pyle-National generators on ten locomotives and a Sunbeam headlight generator on one locomotive; Vapor steam-heat equipment and Ashton steam, steam-heat and air gages.

The coupler at the front of the engine is a National Type E and a Franklin E-2 radial buffer is used between the engine and the tender.

The Tenders

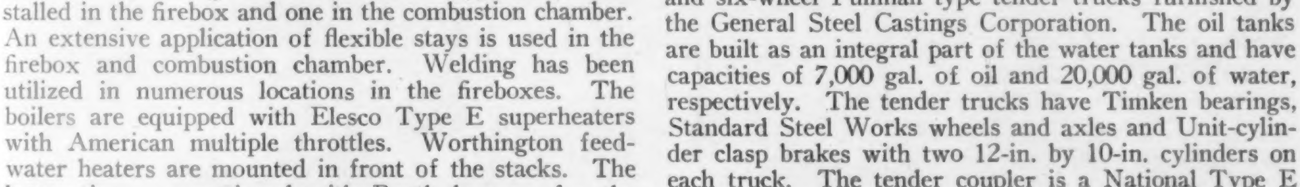
The tenders are of the rectangular type with General Steel Castings Corporation's one-piece cast-steel frames and six-wheel Pullman type tender trucks furnished by the General Steel Castings Corporation. The oil tanks are built as an integral part of the water tanks and have capacities of 7,000 gal. of oil and 20,000 gal. of water, respectively. The tender trucks have Timken bearings, Standard Steel Works wheels and axles and Unit-cylinder clasp brakes with two 12-in. by 10-in. cylinders on each truck. The tender coupler is a National Type E with National yoke and draft gear. Vapor steam heat connectors are used at the rear ends of the tenders.

The Freight Locomotives

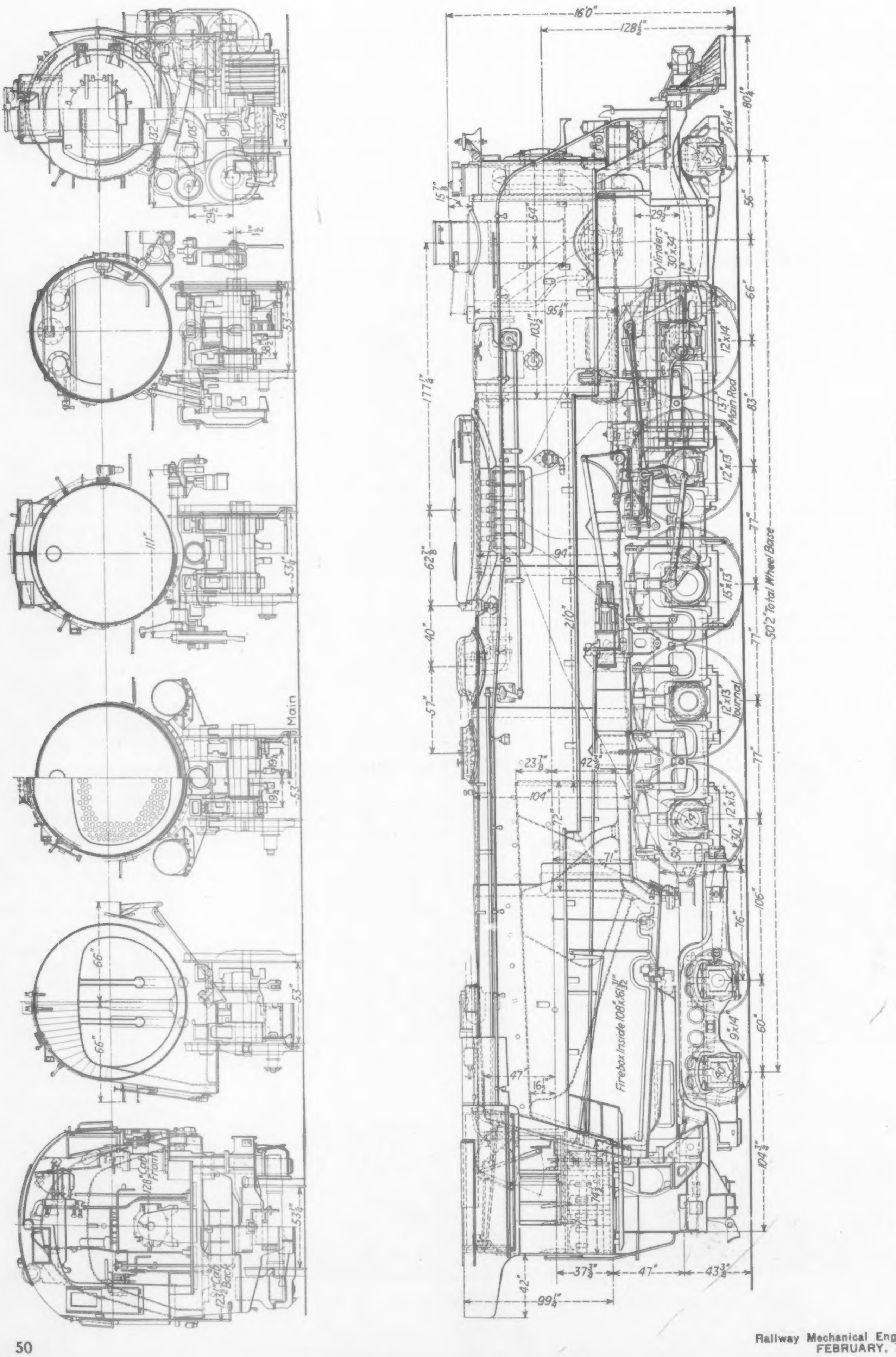
The 2-10-4 type locomotives are a development of the Santa Fe locomotive No. 5000 which was built by Baldwin in 1930. No. 5000 had 69-in. drivers and developed 93,000 lb. tractive force, whereas the present group of 10 locomotives have 74-in. drivers which, with the 310-lb. steam pressure, produce the same tractive force without an increase in cylinder dimensions. The boiler diameter at the front course is two inches larger than the 5000 class, the grate area is the same and the heating surface slightly less due to a reduction in the number of 2¼-in. tubes. The outside diameter of the rear boiler course, in both classes, is 104 in. Five of the locomotives are oil burners and the other five coal burners.

The boilers of these locomotives are built in three

* Described in the March, 1938, *Railway Mechanical Engineer*, page 93.



Santa Fe passenger locomotive for use over heavy mountain grades



Elevation and cross sections of the Santa Fe 2-10-4 type freight locomotive

General Dimensions, Weights and Proportions of the Santa Fe Passenger and Freight Locomotives

	4-8-4	2-10-4 (Coal)	2-10-4 (Oil)
Railroad	A. T. & S. F.	A. T. & S. F.	A. T. & S. F.
Builder	Baldwin	Baldwin	Baldwin
Road numbers	3765–3775	5001–5005	5006–5010
Service	Passenger	Freight	Freight
Dimensions:			
Height of top of stack, ft.-in.	16– 0	16– 0	16– 0
Height to center of boiler, ft.-in.	10–10½	10– 8½	10– 8½
Width overall, ft.-in.	11– 0	11– 0	11– 0
Weight in working order, lb.:			
On drivers	286,890	371,680	371,990
On front truck	90,480	49,920	51,120
On trailing truck	122,230	123,660	115,410
Total engine	499,600	545,260	538,520
Tender	396,340	359,900	393,200
Wheel bases, ft.-in.:			
Driving	21– 3	26– 2	26– 2
Engine, total	48–10	50– 2	50– 2
Engine and tender, total	98– 2½	98– 7¾	100– 3¾
Wheels, diameter, outside tires, in.:			
Driving	80	74	74
Front truck	37	37	37
Trailing truck (rear wheel)	40	40	40
Trailing truck (front wheel)	40	40	40
Engine:			
Cylinders, number, diameter and stroke, in.	2–28x32	2–30x34	2–30x34
Valve gear, type	Walschaert	Walschaert	Walschaert
Valves, piston type, size, in.	15	15	15
Maximum travel, in.:			
Forward	7⅝	7 5/16	7 5/16
Backward	7 5/16	6 15/16	6 15/16
Steam lap, in.	2¼	2	2
Exhaust lap, in.	⅛	⅛	⅛
Lead	¼	3/16	3/16
Boiler:			
Type	Conical	Conical	Conical
Steam pressure, lb. per sq. in.	300	310	310
Diameter first ring, outside in.	88¼	92¼	92¼
Diameter largest, outside in.	102	104	104
Firebox length, in.	144	162	162
Firebox width, in.	108	108	108
Height, mud ring to crown sheet, back, in.	78⅝	76½	76½
Height, mud ring to crown sheet, front, in.	93 5/32	94⅞	94⅞
Combustion chamber length, in.	64	72	72
Arch tubes, number and diameter, in.	None	2–3½	None
Tubes, number and diameter, in.	52–2¼	56–2¼	56–2¼
Flues, number and diameter, in.	220–3½	249–3½	249–3½
Length over tube sheets, ft.-in.	21–0	21–0	21–0
Grate area, sq. ft.	108.0	121.5	121.5
Heating surfaces, sq. ft.:			
Firebox, combustion chamber and syphons	552	610	610
Arch tubes	None	22	None
Firebox, total	552	632	610
Tubes and flues	4,851	5,443	5,443
Evaporative, total	5,403	6,075	6,053
Superheater	2,366	2,675	2,675
Combined evap. and superheating	7,769	8,750	8,728
Tender:			
Type	Rectangular	Rectangular	Rectangular
Water capacity, gal.	20,000	20,000	20,000
Oil capacity, gal.	7,000	....	7,000
Coal capacity, tons	....	23	....
Trucks	6-wheel	6-wheel	6-wheel
General Data:			
Rated tractive force, engine 85 per cent, lb.	66,000	93,000	93,000
Weight proportions:			
Weight on drivers ÷ weight engine per cent	57.4	68.2	69.2
Weight on drivers ÷ tractive force	4.35	4.0	4.0
Weight of engine ÷ evaporation	92.3	89.7	89.0
Weight of engine ÷ comb. heat. surface	64.3	62.3	61.8
Boiler Proportions:			
Firebox heat. surface, per cent comb. heat. surface	7.12	7.23	6.99
Tube-flue heat. surface, per cent comb. heat. surface	62.5	62.2	62.3
Superheat. surface, per cent comb. heat. surface	30.5	30.6	30.6
Firebox heat. surface ÷ grate area	5.12	5.2	5.0
Tube-flue heat. surface ÷ grate area	44.9	44.8	44.8
Superheat. surface ÷ grate area	21.9	22.0	22.0
Comb. heat. surface ÷ grate area	71.8	71.9	71.8
Evaporation ÷ grate area	50.0	50.0	49.8
Tractive force ÷ evaporation	12.2	15.3	15.4
Tractive force ÷ comb. heat. surface	8.49	10.6	10.7
Tractive force x diam. drivers ÷ comb. heat. surface	681.0	786.0	789.0

courses, of which the middle course is conical. They are designed for a working pressure of 310 lb. The barrel and firebox plates were furnished by the Lukens Steel Company, nickel steel being used in the barrel courses, liners, firebox wrapper sheets and back heads. Acid carbon steel is used in the combustion-chamber, crown and sides, and throat and door sheets of the firebox, as well as in both tube sheets. The design of the boilers for both the oil- and the coal-burning locomotives is essentially the same; the oil burners are built with a view to conversion to coal if desired.

The outside diameter of the first course is 94 in. and the third course is 104 in. The combustion chamber is 72 in. long. Except for the use of carbon-steel rivets in the backhead, the rivets used in the construction of the boiler shell are nickel steel. Steel rivets are used in the firebox on one boiler only.

The thickness of the plates is as follows: First course, 7/8 in.; second and third courses, 31/32 in.; wrapper sheet, 29/32 in. on top and 7/16 in. at the sides; throat sheet, 15/16 in.; back head and inside throat sheet, 1/2 in.; firebox crown and side sheets, door and combustion chamber sheets, 13/32 in.; front and back tube sheets, 9/16 in.

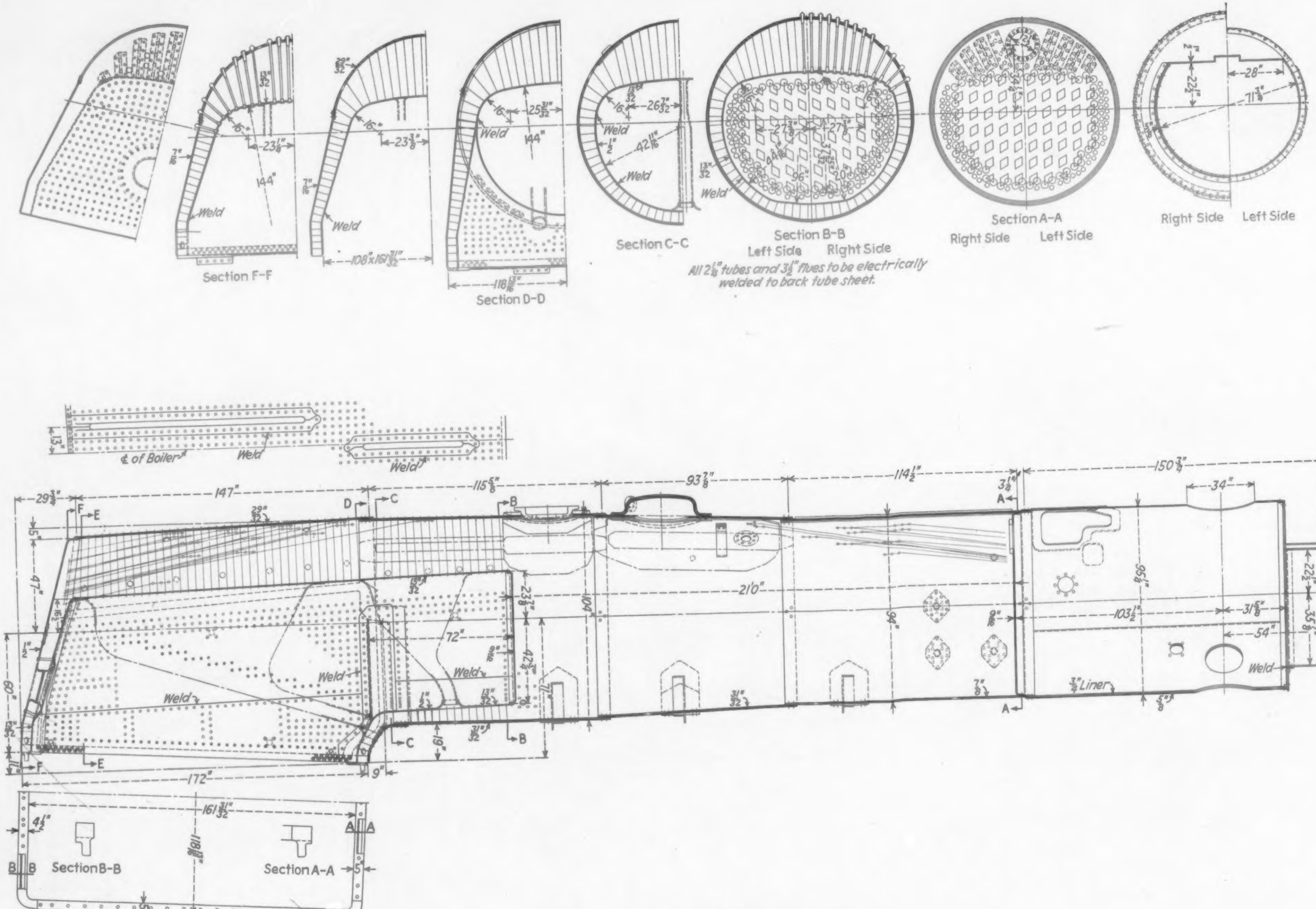
The firebox is 108 in. wide and 162 in. long, with a grate area of 121.5 sq. ft. Three Thermic Syphons are included, two in the firebox and one on the center of the combustion chamber. The Syphons are welded into the firebox sheets. The coal-burning locomotives have Security brick arches with two 3½-in. arch tubes and the oil burners have the staybolts so spaced that the arch tubes may be installed in event of conversion to coal. Booth 3½-in. oil burners are used on the oil-burning locomotives while the other five have Franklin firedoors and grate shakers and Standard Modified Type B stokers. Cast-steel ash and draft pans are used.

On the fireboxes and combustion chambers are extensive applications of Flannery staybolts. Flexible stays with UW sleeves are used in the breaking zones of the firebox, in the combustion chamber and on the back head. The radial crown stays have URW sleeves and KN round nuts except through the syphon flanges. All flexible and expansion stays are hollow bolts for electrical testing.

All 10 locomotives have Elesco Type E superheaters with American multiple throttles. A Worthington 6SA feedwater heater is applied on all 10 locomotives. The heater proper is located in front of the stack; the cold-water pump, on the left side at the rear and the hot-water pump, on the smokebox under the left running board. The injector is a Chicago non-lifting, having a capacity of 13,500 gal. per hour. The safety valves are the Coale 3-in. The boilers are equipped with the Signal Foam-Meter with 1-in. automatic blow-off valves on the right and left sides, piped through a muffler on top of the boiler to the ground. Three Crane blow-off cocks are located in the firebox, one each on the right and left sides and one in the throat sheet. The boilers are equipped with Huron washout plugs.

Machinery Details

The cast steel beds under these locomotives were produced by the General Steel Castings Company and are said to be the largest beds yet in service. The overall length of the bed is 6 ft. 8½ in. and the shipping weight, with the pedestal binders in place, is 84,520 lb. The cylinders and back cylinder heads, the air compressor brackets, and the deck-plate and valve-motion supports are cast integral on all 10 beds. Stoker conveyor and grate-shaker cylinder supports are cast as a part of the oil-burner beds as well as of those for the coal-burning loco-



Santa Fe 2-10-4 type boiler elevation and sections

Partial List of Materials and Equipment on the Atchison, Topeka & Santa Fe 2-10-4 Type Freight Locomotives

Engine bed; engine and trailer trucks; front bumper	General Steel Castings Corp., Eddystone, Pa.
Engine- and trailer-truck wheels; driving-wheel tires; axles; crank pins	Standard Steel Works Co., Burnham, Pa.
Driving-wheel centers	The Baldwin Locomotive Works, Philadelphia, Pa.
Bearings- engine-truck, driving, trailer	Magnus Metal Div., National Lead Co., New York
Driving boxes, front, with lateral motion device	Franklin Railway Supply Co., Inc., New York
Driving boxes (Nos. 3 and 4 axles)	Locomotive Finished Material Co., Atchison, Kan.
Grease cellars	Franklin Railway Supply Co., Inc., New York
Springs	American Steel Foundries, Chicago
Lubricators, mechanical	Ohio Injector Co., Wadsworth, Ohio
Flange oilers	Swanson Co., Chicago
Coupler (front engine)	National Malleable and Steel Castings Co., Cleveland, Ohio
Air brake equipment; air reservoirs	Westinghouse Air Brake Co., Wilmerding, Pa.
Air hose	Goodyear Tire & Rubber Co., Inc., Akron, Ohio
Foundation brakes	American Brake Co., St. Louis, Mo.
Cylinder cocks	The Okadee Company, Chicago
Pistons	Locomotive Finished Material Co., Atchison, Kan.
Piston rods	Standard Steel Works, Burnham, Pa.
Piston and valve-rod packing	U. S. Metallic Packing Co., Philadelphia, Pa.
Power reverse gear	The Baldwin Locomotive Works, Philadelphia, Pa.
Crossheads	Standard Steel Works Co., Burnham, Pa.
Main rod, tandem extended	Franklin Railway Supply Co., Inc., New York
Floating bushings	Magnus Metal Div., National Lead Co., New York
Slidguide attachment	American Locomotive Co., New York
Boiler sheets; tank steel for cab boards, running boards, copper-bearing steel	Lukens Steel Co., Coatesville, Pa.
Boiler shell and back-head rivets	The Champion Rivet Co., Cleveland, Ohio
Firebox rivets, iron	(9) Burden Iron Co., Troy, N. Y.
Staybolt, iron	Ewald Iron Co., Louisville, Ky.
Staybolts, flexible	Flannery Bolt Co., Bridgeville, Pa.
Tubes and flues	(3) The Babcock & Wilcox Tube Co., Beaver Falls, Pa. (2) Globe Steel Tubes Co., Milwaukee, Wis. (5*) Pittsburgh Steel Products Co., Pittsburgh, Pa.
Thermic syphons	Locomotive Firebox Co., Chicago
Brick arch	(5*) American Arch Co., Inc., New York
Firepan brick	(5) American Arch Co., Inc., New York
Arch tubes	(2*) The Babcock & Wilcox Tube Co., Beaver Falls, Pa. (2*) Pittsburgh Steel Products Co., Pittsburgh, Pa. (1*) Globe Steel Tubes Co., Milwaukee, Wis.
Superheaters	The Superheater Company, New York
Throttle	American Throttle Co., New York
Throttle packing	Anchor Packing Co., Philadelphia, Pa.
Lagging	Standard Asbestos Mfg. & Insulating Co., Kansas City, Mo.
Exhaust pipe castings	Locomotive Finished Material Co., Atchison, Kan.
Feedwater heater	Worthington Pump and Machinery Corp., Harrison, N. J.
Injectors	Ohio Injector Co., Wadsworth, Ohio
Blow-off cocks	Crane Co., Chicago
Washout plugs	Huron Mfg. Co., Detroit, Mich.
Stokers	(5*) Standard Stoker Co., Inc., New York
Lubricator for stoker engine	Ohio Injector Co., Wadsworth, Ohio
Draft pan (5) ashpans (5*)	General Steel Castings Corp., Eddystone, Pa.
Firedoors; grate shakers	(5) Franklin Railway Supply Co., Inc., New York
Smokebox hinges	The Okadee Company, Chicago
Cab seats	Gustin-Bacon Mfg. Co., Kansas City, Mo.
Safety valves	Coale Muffler & Safety Valve Co., Baltimore, Md.
Gages, air and steam, steam-heat and air-brake	Ashton Valve Co., Boston, Mass.
Gage holders	Swanson Co., Chicago
Cab and turret valves	Crane Co., Chicago
Train steam heat; cab steam heaters; pressure regulator	Vapor Car Heating Co., Inc., Chicago
Signal Foam-Meter	Dearborn Chemical Company, Chicago
Sanders	Graham-White Sander Corp., Roanoke, Va.
Bell ringer	Viloco Railway Equipment Co., Chicago
Headlight and generator	Pyle-National Co., Chicago
Paint	E. I. duPont de Nemours & Co., Inc., Wilmington, Del.
Oil cut-out cock	(5) Crane Co., Chicago
Radial buffer between engine and tender	Franklin Railway Supply Co., Inc., New York
Drawbars, main and safety	Tennessee Iron
Tender:	
Frame	General Steel Castings Corp., Eddystone, Pa.
Trucks	(5) General Steel Castings Corp., Eddystone, Pa. (5*) Buckeye Steel Castings Co., Columbus, Ohio
Wheels	Standard Steel Works Co., Burnham, Pa.
Unit cylinder clasp brake	American Steel Foundries, Chicago
Journal boxes	(5) Symington Gould Corp., Rochester, N. Y.
Journal friction bearings	Magnus Metal Div., National Lead Co., New York
Coupler; draft gear; draft yoke; uncoupling rigging	National Malleable and Steel Castings Co., Ceveland, Ohio
Back-up lamps	Pyle-National Co., Chicago

* Coal-burning locomotives.

motives, to provide for their conversion to coal as fuel.

The front engine trucks are the two-wheel outside-bearing type furnished by the General Steel Castings Company. They are designed with a one-piece cast-steel frame with provision for 7⅜ in. swing each side of the center line. The engine-truck wheels are 37 in. in diameter and the axles have 8-in. by 14-in. journals with plain bearings.

The four-wheel trailing trucks are the Delta design with centering device. Both axles have 9-in. by 14-in. journals and 40-in. wheels.

The cylinders are 30 in. bore by 34-in. stroke. Cast-iron cylinder and valve-chamber bushings, heat-treated alloy piston heads, phosphor-bronze cylinder and valve packing rings, carbon-steel piston rods, cast-steel Laird-type crossheads with carbon-steel guides and Alco Slidguide attachments are part of the equipment. The valve gear is Walschaert, controlled by a Baldwin type C power reverse gear.

Like the 4-8-4 type locomotives, the freight power is equipped with Baldwin disc driving wheels, 74 in. diameter over the tires. The second, fourth and back drivers have 12-in. by 13-in. journals, while the front and main axles have 12-in. by 14-in. and 15-in. by 13-in. journals, respectively. The driving boxes on the Nos. 1, 2 and 5 axles are the crown-bearing type with Franklin grease cellars. On the No. 1 axle the boxes are fitted with the Franklin lateral-motion device. The boxes on the Nos. 3 and 4 axle journals are Locomotive Finished Materials floating-bushing type.

The driving axles are normalized and tempered carbon-steel forgings, hollow bored with 5-in. diameter holes. Heat-treated nickel-chrome steel is used for the crank pins on the third and fourth pairs of drivers, while on the rest of the wheels the pins are heat-treated carbon steel. The main rods are of the Tandem type. Both main and side rods are of carbon steel, normalized and tempered, and floating bushings are used at the back ends of the main rods. A lateral-motion bushing is used at the front end of the side rod at the No. 1 driver.

Brakes and Auxiliary Equipment

The brake equipment on these locomotives consists of the Westinghouse No. 8ET schedule with two 8½-in. cross-compound compressors located on brackets back of the bumper beam. The engine and trailing trucks have no brakes. Air reservoirs, with a capacity of 77,959 cu. in. are located on brackets under the running boards. One 12-in. by 10-in. brake cylinder is provided for each pair of drivers.

A National Type E coupler is used at the front end of the engine and a Franklin A-1 radial buffer between the engine and the tender.

The headlight and generator were furnished by the Pyle-National Company.

Other equipment on these locomotives consists of Ashton steam and air gages, Crane cab and turret valves,

Comparison of Characteristics of Large 2-10-4 Type Locomotives

Railroad	A. T. & S. F.	A. T. & S. F.	B. & L. E.	C. & O.	C. B. & Q.
Builder	Baldwin	Baldwin	Alco	Lima	Baldwin
Road No.	5001–10	5000	621–30	3000–39	6010–27
Date built	1938	1930	1937	1930	1927-29
Weight on drivers, in working order, lb.	371,680	349,910	369,100	373,000	355,510
Total engine weight, in working order, lb.	545,260	502,260	520,000	566,000	511,710
Weight of tender, in working order, lb.	359,900	377,840	377,200	415,000	385,690
Cylinders, diameter and stroke, in.	30x34	30x34	31x32	29x34	31x32
Driving wheels, diam., in.	74	69	64	69	64
Steam pressure, lb.	310	300	250	260	250
Fuel	(5) Coal (5) Oil	Coal	Coal	Coal	Coal
Grate area, sq. ft.	121.5	121.5	106.6	121.7	106.5
Firebox heating surface, total sq. ft.	632	598	562	645	449
Evaporative heating surface, sq. ft.	6,075	6,114	5,900	6,635	5,904
Superheating surface, sq. ft.	2,675	2,741	2,396	3,030	2,487
Tractive force, engine, lb.	93,000	93,000	97,300	91,584	90,000
Tractive force, booster, lb.	....	....	13,100	15,000	....

Oil-burning fast freight locomotive for service on the Atchison, Topeka & Santa Fe

Vapor cab heaters and train steam-heat equipment and Graham-White sanders. Flexible metallic connections are used on the air reservoirs, steam-heat connections and at the headlight generator, as well as on the oil and steam connections between the engine and tender.

The Tenders

The tenders for the freight locomotives are of the rectangular type with water capacity of 20,000 gal.

Copper-bearing steel is used in the tanks. On the oil-burning power the fuel capacity is 7,000-gal. and provision is made in the tanks for 30 cu. ft. of flue sand. The coal-burning locomotives have no provision for sand and have coal capacity for 23 tons.

The tenders of the oil-burning locomotives are carried on two General Steel Castings six-wheel Pullman-type trucks—of the same design as used on the 4-6-3 and 4-8-4 passenger power. The coal burners have tender trucks built by the Buckeye Steel Castings Company which are interchangeable with those on the oil-burning locomotives. All 10 locomotives have 37-in. tender wheels and 7-in. by 13-in. plain-bearing journals. Unit cylinder clasp brakes with two 10-in. by 10-in. brake cylinders are part of the equipment on each truck.

The tender frames were cast by the General Steel Castings Corporation and are of the water-bottom type. The frames of the oil burners are arranged for conversion to coal as fuel.

The couplers, draft gears, and yokes were furnished by the National Malleable and Steel Castings Company.

Details of the running gear of one of the 2-10-4 type locomotives

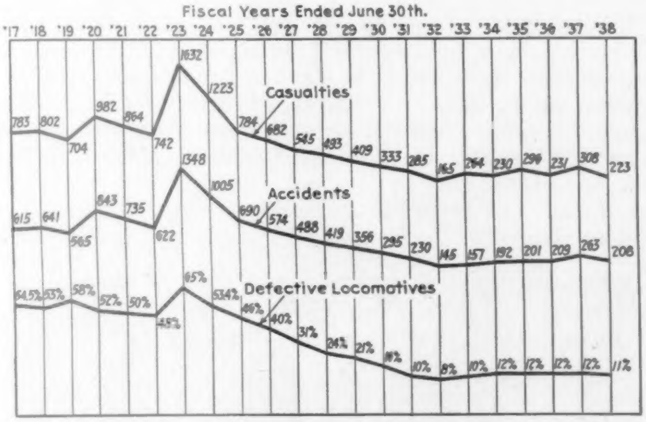
Annual Report of the Bureau of

Locomotive Inspection

Report of inspections of steam locomotives shows that 5.1 per cent more inspections were made and defects decreased 15 per cent

The annual report of the Bureau of Locomotive Inspection, Interstate Commerce Commission, submitted by John M. Hall, chief inspector, covering the fiscal year ended June 30, 1938, shows an increase of 5,153 locomotives inspected as compared with the previous year; a decrease of 1,352 in the number of locomotives found defective; a decrease of 1 per cent in the number inspected and found defective; a decrease of 255 in the number ordered out of service, and a decrease of 7,532 in the total number of defects found. The above figures apply only to steam locomotives.

The accompanying chart shows the percentage of defective locomotives, the number of accidents and the number of casualties for the fiscal years ended June 30, 1917, to 1938, inclusive. Summaries and tables included in the report show separately accidents and other data

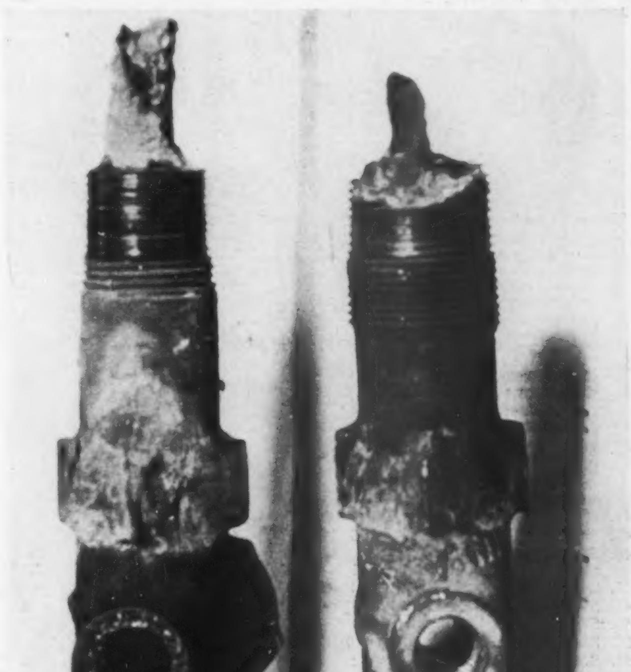


This chart shows the situation as to accidents, casualties and defective locomotives over a 22-year period

in connection with steam locomotives and tenders and their appurtenances, and accidents and other data in connection with locomotives other than steam.

In addition to the accidents shown in the tables and otherwise referred to in this report there was reported to the bureau a total of 84 accidents in which 7 employees were killed and 77 employees injured in falls while in the performance of their duties on locomotives. None of these falls could be attributed to the condition of the locomotives, it being apparent in each instance that the falls were caused by inattention or sudden illness on the part of those killed and injured. These accidents

Another case of low water resulting in the death of an employee. The force of the explosion hurled the boiler 200 ft.



Condition of two bottom water glass cocks as found by inspector. The extension into the water space in each case was corroded and in one case it affected part of the threads

do not come within the scope of the locomotive inspection law, but were mentioned in the report in order to emphasize the necessity of alertness on the part of all persons employed on or about locomotives.

During the fiscal year ended June 30, 1938, the number of steam locomotives inspected totaled 105,186, of which 11,050, or 11 per cent, were found defective, and 679 were ordered out of service. In 1937 there were 100,033 steam locomotives inspected, of which 12,402 were found defective and 934 ordered out of service. In the year ended June 30, 1936, a total of 97,329 loco-

Number of Steam Locomotives Reported, Inspected, Found Defective, and Ordered from Service

Parts defective, inoperative or missing, or in violation of rules	Year ended June 30— 1938	1937	1936	1935	1934	1933
1. Air compressors...	689	766	740	733	660	474
2. Arch tubes	66	105	74	74	127	51
3. Ashpans and mechanism	72	80	79	94	87	40
4. Axles	13	10	13	10	6	21
5. Blow-off cocks	226	199	236	283	289	210
6. Boiler checks	301	382	356	413	407	293
7. Boiler shell	331	347	383	396	372	296
8. Brake equipment...	2,044	2,322	2,480	2,449	2,326	1,696
9. Cabs, cab windows, and curtains	1,226	1,807	1,638	1,273	1,342	1,183
10. Cab aprons and decks	326	466	450	368	343	309
11. Cab cards	109	145	166	142	129	121
12. Coupling and uncoupling devices ..	73	74	65	73	54	67
13. Crossheads, guides, pistons, and piston rods	905	1,160	1,056	1,086	1,100	773
14. Crown bolts	59	76	63	75	77	67
15. Cylinders, saddles, and steam chests...	1,645	2,206	1,717	1,547	1,491	1,084
16. Cylinder cocks and rigging	585	729	605	627	654	374
17. Domes and dome caps	109	101	114	94	105	76
18. Draft gear	740	522	513	423	401	318
19. Draw gear	479	560	451	414	480	357
20. Driving boxes, shoes, wedges, pedestals, and braces	1,688	1,637	1,712	1,573	1,472	1,080
21. Firebox sheets	244	371	295	343	356	246
22 Flues	159	225	178	173	203	150
23. Frames, tail pieces, and braces, locomotive	1,001	1,053	997	1,006	951	669
24. Frames, tender ...	131	120	113	124	128	80
25. Gages and gage fittings, air	230	261	257	275	212	145
26. Gages and gage fittings, steam	279	324	350	320	289	258
27. Gage cocks	451	538	579	480	384	388
28. Grate shakers and fire doors	403	470	400	394	404	245
29. Handholds	405	510	502	464	377	363
30. Injectors, inoperative	26	38	40	39	33	20
31. Injectors and connections	1,784	2,020	2,085	2,035	1,909	1,357
32. Inspections and tests not made as required	8,204	9,638	9,005	8,344	8,173	6,358
33. Lateral motion	325	446	404	389	351	269
34. Lights, cab and classification	48	90	78	81	79	76
35. Lights, headlight ..	257	313	251	257	218	169
36. Lubricators and shields	212	254	255	191	215	157
37. Mud rings	203	272	237	241	247	232
38. Packing nuts	448	487	508	527	491	419
39. Packing, piston rod and valve stem	913	1,393	1,133	906	833	592
40. Pilots and pilot beams	154	133	178	152	174	123
41. Plugs and studs ..	238	238	236	167	242	151
42. Reversing gear	404	492	463	414	390	254
43. Rods, main and side, crank pins, and collars	1,669	2,348	2,093	1,826	1,670	1,327
44. Safety valves	125	132	125	100	108	53
45. Sanders	536	655	678	779	697	376
46. Springs and spring rigging	2,901	3,172	3,008	2,765	2,854	2,122
47. Squirt hose	94	133	134	113	107	93
48. Stay bolts	211	276	279	240	285	219
49. Stay bolts, broken	380	542	520	512	455	368
50. Steam pipes	410	446	526	463	489	338
51. Steam valves	141	165	227	212	267	193
52. Steps	631	678	615	640	567	498
53. Tanks and tank valves	955	1,009	877	913	862	600
54. Telltale holes	67	79	127	102	93	90
55. Throttle and throttle rigging	685	909	760	733	639	448
56. Trucks, engine and trailing	762	785	861	811	898	664
57. Trucks, tender ...	907	1,018	1,108	1,120	918	747
58. Valve motion	722	798	824	799	784	640
59. Washout plugs ...	626	598	714	679	776	623
60. Train-control equipment	11	12	6	4	8	4
61. Water glasses, fittings, and shields .	915	1,049	1,118	951	907	716
62. Wheels	577	803	790	697	734	580
63. Miscellaneous — Signal appliances, badge plates, brakes, (hand)	684	759	608	563	572	423
Total number of defects	42,214	49,746	47,453	44,491	43,271	32,733
Locomotives reported.	47,397	48,025	49,322	51,283	54,283	56,971
Locomotives inspected	105,186	100,033	97,329	94,151	89,716	87,658
Locomotives defective	11,050	12,402	11,526	11,071	10,713	8,388
Percentage of inspected found defective	11	12	12	12	12	10
Locomotives ordered out of service	679	934	852	921	754	544

motives were inspected, of which 11,526 were found defective and 852 ordered out of service. The total number of defects found and shown in the last three reports were: 42,214 in 1938, 49,746 in 1937, and 47,453 in 1936.

There was a decrease of 4 in the number of accidents, a decrease of 12 in the number of persons killed, and a decrease of 7 in the number of persons injured as a result of boiler explosions or crown-sheet accidents as compared with the previous year.

All of the five explosions that occurred in the past fiscal year, in which five persons were killed and three

Accidents and Casualties Caused by Failure of Some Part of the Steam Locomotive, Including Boiler, or Tender

	Year ended June 30 1938	1937	1936	1935	1934	1933
Number of accidents	208	263	209	201	192	157
Per cent increase or decrease from previous year	20.9	*25.8	*4.0	*4.7	*22.3	*8.3
Number of persons killed	7	25	16	29	7	8
Per cent increase or decrease from previous year	72.0	*52.2	44.8	*314.3	12.5	11.1
Number of persons injured	216	283	215	267	223	256
Per cent increase or decrease from previous year	23.7	*31.6	19.5	*19.7	12.9	*64.1

* Increase.

injured, were caused by the overheating of the crown sheets due to low water. This is the least number of explosions experienced in any one year ever recorded with the exception of the fiscal year ended June 30, 1933, in which year the same number of explosions occurred, resulting in the death of two persons and the injury of six.

Boiler and appurtenance accidents other than explosions resulted in the injury of 56 persons; compared with

A broken main rod caused this puncture in the bottom of the barrel of a boiler

the previous year this is a reduction of 2 persons killed and 4 persons injured in accidents originating from failures of these parts.

Time Extensions for Flue Removals

A total of 680 applications were filed with the bureau for the extension of time for the removal of flues as provided in Rule 10. The investigations of the bureau disclosed that in 46 of these cases the condition of the locomotives was such that the extensions could not properly be granted. In 30 cases the full extension could not be authorized, but extensions for shorter periods of time were allowed. In 31 other cases extensions were granted after defects disclosed by the inspectors were repaired. Thirteen applications were cancelled for

various reasons. Extensions of time for full periods were granted in 560 cases.

Locomotives Other Than Steam

There was a decrease of 8 in the number of accidents occurring in connection with locomotives other than steam and a decrease of 10 in the number of persons injured as compared with the previous year. No deaths occurred in either year.

During the year seven per cent of the locomotives inspected were found with defects or errors in inspection that should have been corrected before the locomotives were put into use as compared with nine per cent in the previous year. There was a decrease of 15 in the number of locomotives ordered withheld from service because of the presence of defects that rendered the locomotives immediately unsafe.

Specification Cards and Alteration Reports

Under Rule 54 of the Rules and Instructions for Inspection and Testing of Steam Locomotives, 412 specification cards and 4,438 alteration reports were filed, checked, and analyzed. These reports are necessary in order to determine whether or not the boilers represented were so constructed or repaired as to render safe and proper service and whether the stresses were within the allowed limits. Corrective measures were taken with respect to numerous discrepancies found.

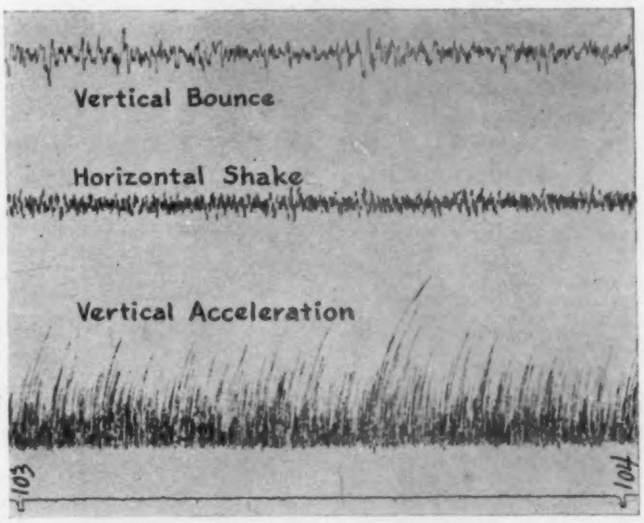
Under Rules 328 and 329 of the Rules and Instructions for Inspection and Testing of Locomotives Other Than Steam, 228 specifications and 51 alteration reports were filed for locomotive units and 98 specifications and 45 alteration reports were filed for boilers mounted on locomotives other than steam. These were checked and analyzed and corrective measures taken with respect to discrepancies found.

No formal appeal by any carrier was taken from the decisions of any inspector during the year.

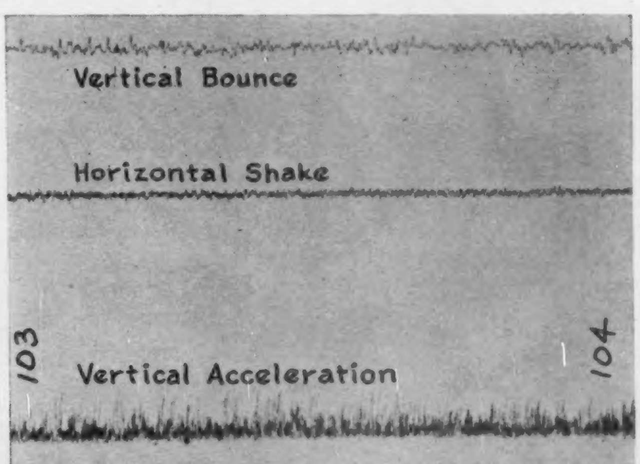
Low water caused this explosion resulting in the death of three employees. Parts of the wreckage were scattered in all directions for various distances up to 1,170 ft.

Reduction of Locomotive Vibration

It is a well-known fact that a great amount of so-called hard riding of locomotives has been due, first, to inability entirely to eliminate slack or lost motion between engine



A-1 wedge type buffer—54.5 m. p. h., November 21, 1938



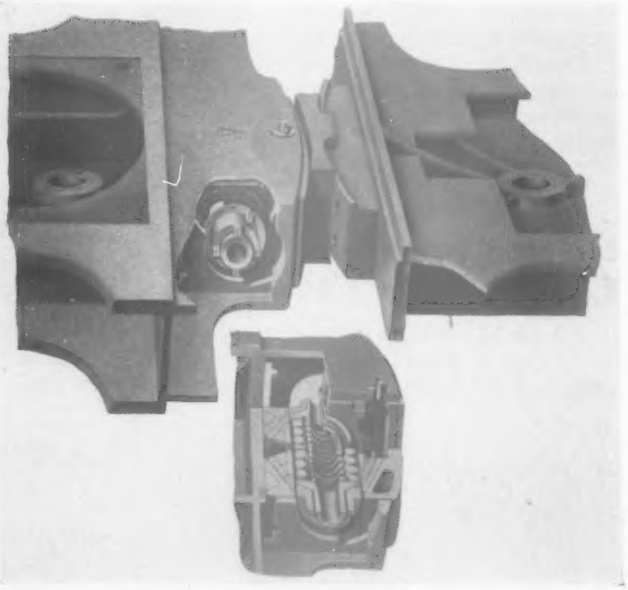
E-2 type radial buffer—54.6 m. p. h., November 23, 1938. (Same locomotive as above)

Sections from shock and vibration recorder tapes showing the effect of the spring-actuated friction-type radial buffer in steadying the riding of the locomotive

and tender and, second, to inability to dampen the horizontal unbalanced forces of the reciprocating masses.

Heretofore, the mechanism used between engine and tender has been the wedge type radial buffer, or the spring buffer types, the inadequacy of which became pronounced with the advent of higher speeds.

Some years ago the Franklin Railway Supply Company developed and has since placed in service on many



The E-2 type radial buffer

locomotives the E-2 radial buffer,* an automatic mechanism embodying two principles: first, the entire elimination of slack between engine and tender; second, the utilization of spring-actuated friction members which provide high resistance to the forces of compression between engine and tender. The utilization of these principles makes possible a design of buffer that enables the tender to become practically an integral part of the locomotive. The E-2 buffer still retains adequate provisions for radial action and disalignment caused by curving, turnouts, and track irregularities. Application of the improved design of buffer has resulted not only in greatly improved riding qualities of the locomotive, but has also brought about a very material reduction in maintenance costs that result from such factors as loose cabs, broken piping, displaced arch bricks, worn drawbars, drawbar pins and chafing plates.

Recently some comparative tests between the old and new type buffers were made in passenger service on a western railroad. These tests were made with a shock and vibration recorder. This type of instrument, illustrated in the photograph, is well recognized as an apparatus for securing accurate data in connection with the riding qualities of rolling stock. As a part of its development it was tested for accuracy on the shake tables at Purdue University. On the road tests this shock and recording instrument was secured to the deck of the locomotive below the engineer's seat box.

The comparative tests were made with the same locomotive, a 4-8-2 type with 74-in. driving wheels. The tests were conducted with the same number of passenger cars, over the same track, and on the same operating schedule. No work was done upon the locomotive between tests other than the change of buffers. Track conditions were exceptionally fine.

The first test was conducted with the locomotive equipped with the old-style wedge buffer which was in excellent working condition and properly adjusted. Two days later the comparative test was run with the E-2 buffer.

The chart contains reproductions of comparative and representative portions of the records made by the automatic recorder between mile posts 103 and 104. The upper half of the illustration shows the performance with the old-style buffer. The lower half shows the performance with the E-2 buffer and clearly indicates the benefits obtained. The speeds over this section of track were practically identical.

These comparative graphical records show the improvement that can be made in the riding qualities of a locomotive with the E-2 buffer, particularly in smoothing out or damping the effect of the unbalanced forces of the reciprocating masses.

The vertical displacement of the upper line, marked "Vertical Bounce," is equal to one-third of the actual vertical movement of the locomotive on the chart from the instrument.** With the old buffer a maximum vertical displacement of 0.45 in. is shown as compared with a maximum of 0.25 in. on the chart of the test with the new buffer. This is a reduction of 50 per cent in favor of the new buffer.

The vertical displacement of the second line on the chart ** measures approximately one-half of the actual fore-and-aft horizontal shake of the locomotive largely due to the unbalanced forces of the reciprocating masses and inherent factors of steam distribution. An average measurement of this line on the test with the old-type buffer is approximately 0.20 in. as compared with 0.06 in. with the new buffer, or a reduction of approximately 66 per cent. This indicates that the damping properties of the improved design of buffer have been very successful in absorbing or diminishing the horizontal shake so that it indicates less than one-third of that obtained with the old buffer.

The third line on the chart, labeled "Vertical Acceleration," has a definite relation to the upper line and is really an indication of the change of velocity during the vertical movement, or, in other words, the shock of the impact caused by the vertical movement. One-inch movement of the pencil ** represents an acceleration of one *G* (32.2 ft. per second per second). A comparison of the maximum deflection of this line shows 1.40 *G* with the old buffer and 0.53 *G* with the new buffer, a reduction of approximately 62 per cent. If it were pos-

* For a complete description of the E-2 buffer see the *Railway Mechanical Engineer* for April, 1934, page 110.

** The illustration in this article is two-thirds the full size of the charts taken from the instrument.

The shock and vibration recorder with which the comparative records were made

sible to determine an average of this line, it would probably be still less—only about one-fourth of the average obtained with the old buffer.

The best possible counterbalancing of a locomotive is highly essential for the best practical and economical results from a locomotive and track structure standpoint. But even when that is accomplished, the test data described herein indicate how a buffer making the tender, in effect, an integral part of the locomotive can absorb the effects of unbalanced forces and at the same time provide increased comfort for engine crews and train passengers and afford the means for greatly reduced maintenance costs.

In addition, the damping effect afforded by the new buffer suggests the possibility of still further reduction in the percentage of locomotive reciprocating weights balanced which, in turn, will decrease dynamic augment and the resulting track stresses.

Barber Freight-Car Snubber

The new Barber snubber illustrated has recently been developed by the Standard Car Truck Company, Chicago, especially for inclusion in the spring group of freight cars to promote easy riding, reduce lading damage claims occasioned by the vertical harmonic action of the springs, and reduce the general maintenance expense of cars. The unique features of this snubber are

Barber freight-car-truck snubber, notable for simple, rugged construction and large friction surfaces

that it displaces two springs of the group instead of one as is customary with the barrel-type snubber, and has large frictional area, producing low pressure per square inch of contact.

It is preferably applied lengthwise of the car, and when substituted for the two outside springs it is exposed for easy inspection. The illustration shows the snubber applied in the spring group in combination with a flanged type of spring plate.

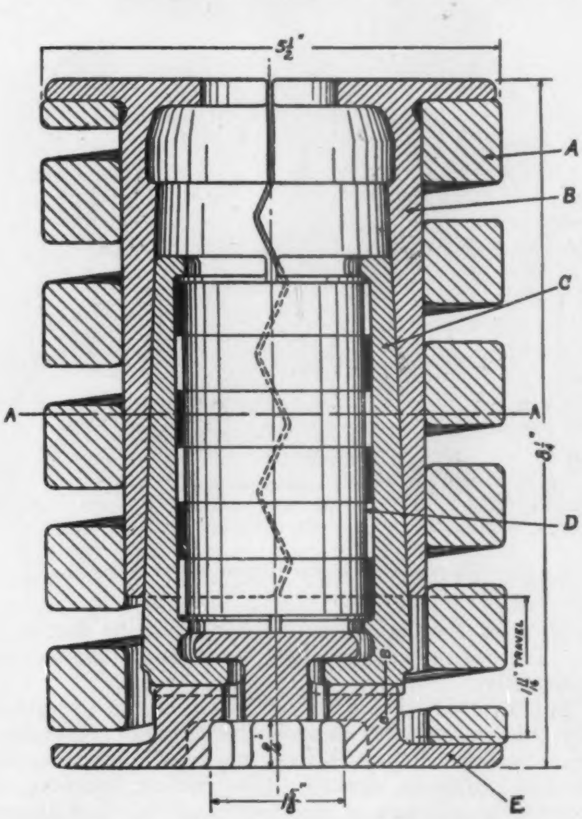
The upper and lower housings of this snubber are interchangeable as are also the friction castings. The housings are made of heat-treated alloy cast steel, and so designed as to fit into any standard type of plain or flanged spring plate for use with the conventional type of side frame for freight-car trucks. The friction castings are of special alloy friction iron which operate against a double-coil spring.

This snubber is simple in design, free of small pieces that usually show rapid wear, and is said to produce an exceptionally easy ride under all conditions of load. Because of the large area of frictional contact, the pressure per square inch exerted against the friction members is unusually low, thereby tending to assure long and satisfactory life.

Friction Bolster Spring

The Type-H friction bolster spring, recently developed by the Railway Truck Corporation, Chicago, Ill., is designed to protect equipment and lading from vertical shocks in modern high-speed freight-train operation, by utilizing the largest possible frictional surfaces in the space available and thus reducing to a minimum the unit working pressure.

The distribution of work in this unit, the construction of which is clearly shown in the illustrations, is spread over three surfaces as follows, expressed in terms of travel area: Surface between shoes and casing, 70 sq.



Cross-section of Type H railway-truck friction bolster spring

in. of travel area; surface between main spring and casing, 12.5 sq. in. of travel area; surface between inner springs and shoes, 3.25 sq. in. of travel area; total, 85.75 sq. in. of travel area.

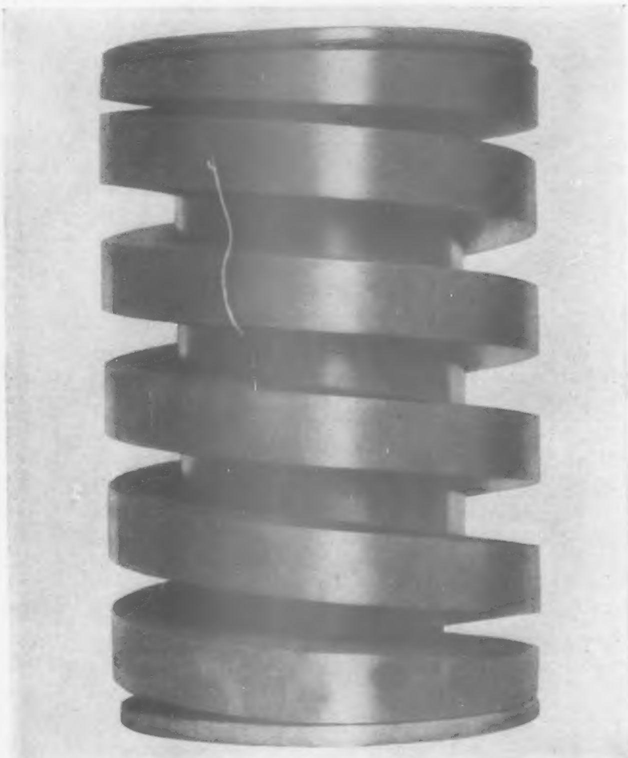
The surface between the shoes and casing develops 82 per cent of the work in the unit, the balance, or 18 per cent, being developed between the springs and their respective surfaces. The unit has reserve travel of 1/8 in. after the bolster springs go solid; the main spring *A* has a further reserve of another 1/8 in.

The inner split-ring springs *D* are placed under sufficient compression always to insure ample resistance to the inward movement of friction shoes and take up slack due to wear. When in service, the actual move-

ment of these inner springs is very small; consequently the tendency toward fatigue is negligible.

The casing B is made in three parts with its edge surfaces staggered to prevent ridges wearing on the surface of friction shoes. This casing is made of forged alloy material, heat treated to resist wear. The frictional shoes C are also forged. The base casting E is made of electric cast steel, electrically galvanized.

This device can be taken apart and re-assembled without the use of any tools or shop equipment, in a few minutes. A few end blows place the shoes in proper



Exterior view of the friction bolster spring

position so as to bring the free length of the unit to 8⅜ in. The device is designed so that it cannot be assembled incorrectly.

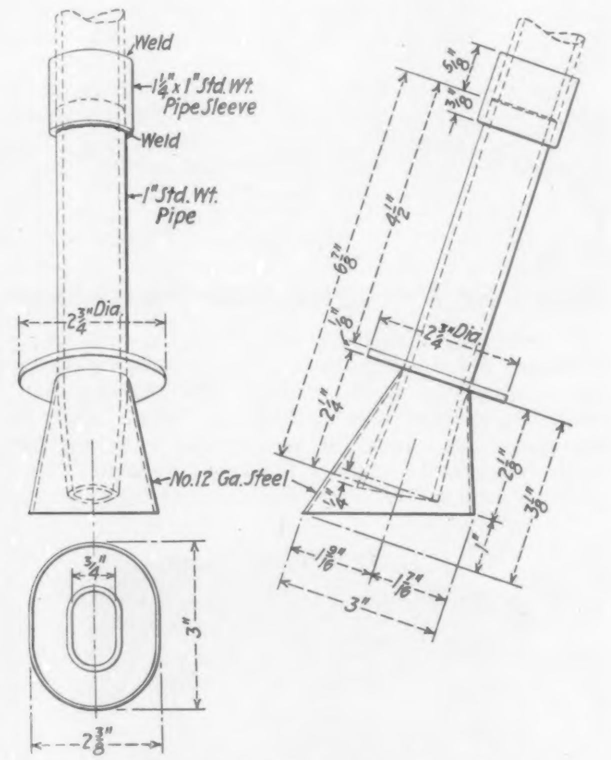
The Type-H friction bolster spring is said to eliminate approximately 80 per cent of the vibration of ordinary truck spring groups, which is the maximum absorption capacity ordinarily desired. One friction bolster spring inserted in each nest of truck springs, placed in diagonal corners of the bolster, is recommended practice. Where friction bolster springs have been applied, an appreciable increase has been noted in the life of bolster springs, and other car parts, as well as reduced damage to lading.

A New Locomotive Sander Pipe End

While it is customary to give great care and attention to supplying dry sand to locomotives at engine terminals, much of the benefit may be lost by the effect of moisture in congealing the sand at the lower discharge ends of the sander pipes. This condition is particularly aggravating in freezing weather.

To overcome this difficulty, the Soo Line has, for several years, been using a skirted sander pipe end originated by J. B. Swan, a locomotive engineman on this road. This sander pipe end is shown, as finally perfected, in the accompanying drawing.

The oval skirt surrounding the pipe end serves to catch the moisture which, in the wind, purls to the bottom, and is prevented from reaching the sand flow exit. The



Wilson double-skirted sander-pipe end

top skirt or washer is included in the design principally to serve the purpose of an anvil for members of engine crews to strike in conformity with habit when they assume that the pipe is blocked.

This device is manufactured and marketed by the Wilson Engineering Corporation, Chicago.

Cork and Rubber Molded Sound Insulation

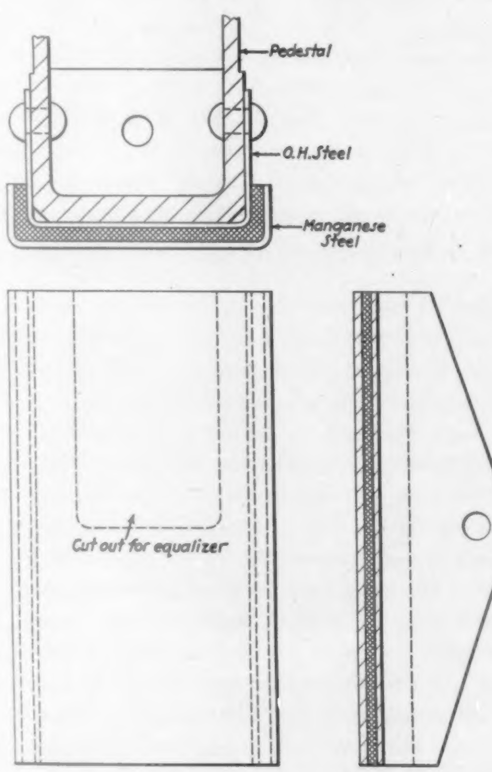
A means for preventing sound transmission from rail to truck and into the body of the railroad car by the use of cork and rubber, and cork and synthetic rubber compounds has recently been developed by the Armstrong Cork Company, Lancaster, Pa. The pedestal is isolated from the journal box and the helical springs from the equalizer bar and the truck frame by preformed pads of the insulating material.

One of the drawings shows a pedestal liner of the riveted type. The insulating material is molded between the back and the wearing face of the liner, to both of which it is vulcanized. The wearing face is preferably made of manganese steel, but sometimes made of spring steel. The thickness of the liner is held to very close tolerances.

Pedestal liners can be furnished in three types: the riveted type shown, the bolted type, and the tack-welded type. The face dimension or width overall of the liners

may be 8 in., 7¾ in. or 6⅜ in., as required. This dimension can be varied to meet the specifications. The length of the face may be from 18½ in. down to 14½ in. and can also be varied as needed. The outer liner is made with a solid face, and the inner or equalizer liner has the face cut out, as shown in dotted lines, to allow the equalizer bar to rest on the journal box. The width of the cut-out prevents metallic contact being made with the side of the liner or pedestal.

When lubrication is used on the pedestal, the composition or isolation material is made with a synthetic rubber base and cork. If the pedestal is not lubricated, a rubber and cork composition is used. The composition is bodily compressible to a degree that can be closely controlled. This property of controlled body compressibility, combined with controlled flow, makes this material peculiarly adaptable for this application. Rubber, on the other hand, under compression, must flow in some direction. This flow, or change of shape, causes a movement on the face and in the body of the material, and it is

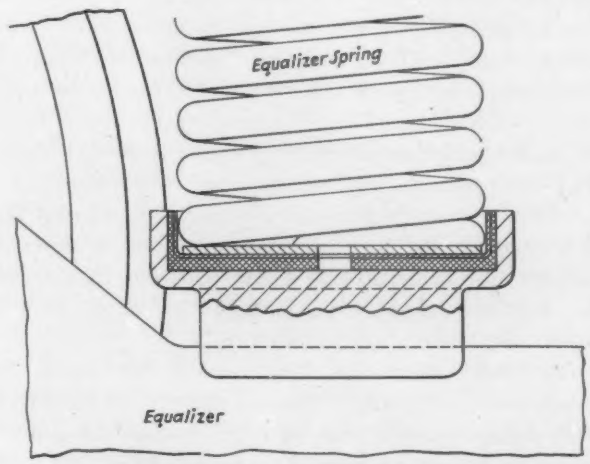


Sound-insulated pedestal liner

necessary to provide for this by placing holes, slots, or other means in the rubber, or in the confining metal. These holes, or slots, open the piece and permit lubricants and other materials to enter and attack the bond between the rubber and the metal. In addition, the tendency of rubber to flow tends to pull the stock away from the metal and destroy the vulcanized bond. In a compressible stock such as is used in these pads the flow is said to be in the direction of the applied force, which does not weaken the bond.

The use of the liners completely isolates the journal box from the pedestal and thus reduces the transfer of track noises and prevents their passing through the axle to the journal box into the body of the truck, except through the one remaining contact, which is the equalizer spring. Isolation of this spring is accomplished by the use of pads shown in the small drawing.

This isolation is obtained by means of the drawn steel cup into which the equalizer spring fits. This cup is reinforced at the bottom with a steel disc, which is electrically spot welded in place. The cup and disc have holes in the center to allow for drainage of water. The Armstrong cushion material is vulcanized to the bottom and outer edges of the cup flange in sufficient thickness to break the transmission of vibration and noise. The



Insulating pad for equalizer springs

pads are generally of ½-in. thickness at the base and standard sizes are made for 8-in. and 9-in. springs.

These pedestal liners and equalizer spring pads can be used on both four- and six-wheel trucks. By their use all metallic contact between the rail and the body of the car is broken.

General Overhaul of the New Haven Comet

(Continued from page 48)

plugged fuel-oil strainer in the No. 1 engine, was excellent in all respects. There were no hot bearings and the riding qualities of the train were considered to be equal to the original.

On the return to the shop, various odds and ends were finished up, seats and drapes were installed, and two days later the train was turned over to the operating department for return to Boston.

Conclusion

A general overhaul is one of the important occurrences in the life of a train like the Comet. The first one in particular inevitably brings to light conditions which definitely require correction, and the effectiveness of the remedies applied has a great bearing on the future of the train. In many instances the problems arising are entirely new, with little if any direct precedent for guidance. Likewise in any wholesale renewal of parts there is the question of changes in design of some of these parts. While very probably these changes are the result of progress and improvement, there is always the uncertainty of their success under special conditions. Hence, the real problem of a general overhaul is not alone the immediate one of return of the train to its original qualities of performance and comfort.

On the basis of the test results, it is believed that the general condition of The Comet is as good as, if not better than, it has ever been, and it is hoped that, barring minor troubles inherent in any major dismantling and re-assembly of equipment, this will be reflected in satisfactory service until the next general overhaul.

EDITORIALS

Dirt Behind The Ears

Air conditioning opened an era of cleanliness in passenger trains which immediately widened the range of possibilities for interior decoration. Pastel colors and drapes have been employed extensively in the interiors of the recently built deluxe high-speed passenger trains. The improvement in interior coach conditions, particularly with respect to the freedom from the infiltration of dust and fine cinders around the windows, is sufficiently popular so that a few years ago light colors for modern travel were advocated in ladies' apparel advertising.

Obviously, there must be a strong contrast in the appearance and attractiveness of the new, much-advertised deluxe trains and those which operate on secondary main-line schedules and on branch lines. If there were no contrast there would be no deluxe trains. There should, however, be a common basic standard of cleanliness for all passenger trains. Of course, cars without air conditioning and cars on local runs will not stay as clean as those which are air-conditioned and those operating on long non-stop runs. But the complete neglect, which is apparently the lot of most coaches on branch-line trains and many of those on secondary main-line trains, is evidence that too much of the psychology of the days when Pullman travelers were passengers and coach travelers were cattle still pervades the managements of American railroads. The coach passenger was not supposed to know how to treat anything in the nature of homelike furnishings. It was, in fact, assumed that he had no objection to traveling in filth, and the condition of many of the coaches in which he had to travel certainly did not suggest the idea that he need be careful in his treatment of the seats and floor of a coach, as he would be in his own home.

This attitude, no doubt, is the heritage of frontier days. Conditions, however, have changed. The frontier has been replaced with a type of material civilization peculiar to America, the emblem of which is the modern bathroom. There are few places in this country where the excuse that decent coach interiors will not be respected can be cited legitimately in justification of neglect of a decent standard of cleanliness or, indeed, for failure to provide attractive coach interiors. Dirty and vile-smelling branch-line coaches are a definite asset to bus lines and, in areas back from the main lines, are definitely creating an unfavorable public reaction which is canceling out some of the effectiveness and merchandising value of the advertised service on the main lines.

Recent attempts at restoring a favorable public reaction to local services, by redecorating and refurnishing the interiors of the coaches of important local trains, are a hopeful sign. Such efforts should continue to spread until the last railway coach on the continent has become at least as attractive as the bus with which it has to compete and then is maintained in a state of self-respecting cleanliness.

Economics of Light-Weight Freight Cars

At the November 21 meeting of the Western Railway Club at Chicago, K. F. Nystrom, mechanical assistant to vice-president, Chicago, Milwaukee, St. Paul & Pacific, discussed both the economics and engineering of lightweight freight cars, and reached the somewhat startling conclusion that 2,000,000 new freight cars should be built in the next ten years. Mr. Nystrom said, "The savings which would result in reducing weight on the scale previously given, namely, $60 per car per year, applied to the 2,000,000 cars to be built would amount to $12,000,000 annually for each year the quota of new cars are in service, and this saving will multiply as additional new cars are added each year, or a total saving in ten years of $660,000,000; allowing that conservative engineers would prefer to accept only 50 per cent, the possible saving still is enormous. To build 2,000,000 freight cars at a cost of say $2,000 each, would be a capital investment of four billion dollars which would go a long way toward restoring employment and prosperity."

Various estimates have been made regarding the possible savings as a result of reducing the tare weight of freight cars, one of the most commonly quoted being $18 per ton per year. Among those who contributed to the discussion following Mr. Nystrom's paper was G. S. Goodwin, mechanical engineer, Chicago, Rock Island & Pacific, who submitted the accompanying table giving a breakdown of weight savings and resultant increases in cost of various detail parts of a modern lightweight steel box car, and setting up an estimated net saving by reduced weight of $17.15 per car per year, which corresponds quite closely with the figure previously mentioned.

The concensus of the meeting was that while the new high-tensile low-alloy steels have not, in general, been in service long enough to demonstrate fully their corrosion-resistance properties, the indications are that their expected service life will probably be as much greater than that of copper-bearing steel as the latter is greater than carbon steel. Economies as the result of weight savings are also of great importance and will prove of benefit to all railroads in proportion to the speed with which the modern lightweight freight cars

are installed in actual service to replace the old heavy equipment.

Detailed Freight-Car Weight Savings and Costs-Economies

	Reduction in weight	Increase in price
Cor-ten and Man-ten in underframe and sides of car—includes castings	2,200	$65.36
Roof—(Estimated)	300	13.75
Murphy ends—(Estimated)	550	36.30
Side doors	410	19.18
Side door fixtures	184 Cr.	1.85
Coupler yokes	100	7.00
Couplers	200	12.00
Truck side frames	400	39.00
Truck bolsters	350	21.70
Total	4,694	$212.44

THE ECONOMICS OF LIGHT WEIGHT

Saving in deadweight, lb.	4,700
Miles per year on own line (30 miles per day for 200 days)	6000
Ton miles	14,200
*Cost to move one net ton freight from annual report at .0037 multiplied by ½ is	.00185
Saving account hauling less weight	$26.27
Increased ton miles due to heavier load for 600 miles (1/10 of total miles on line)	1410
Revenue at 1 cent per ton mile	$14.10
Total savings per year	$40.37
Interest on investment of $212.44	19%
Saving per ton reduced weight	$17.15

* This figure is produced by multiplying the cost of moving one net ton of revenue freight by the ratio of weight of average live load to total weight of car at rail.

Progress Continues in Locomotive Maintenance

The twenty-seventh annual report of the chief inspector of the Bureau of Locomotive Inspection to the Interstate Commerce Commission for the fiscal year ended June 30, 1938, which appears in abstract elsewhere in this issue, contains, in its statistics, a rather significant story of the progress that is being made by the railroads of this country in locomotive maintenance. Viewed from the standpoint of the number of locomotives found defective and the number of defects found by the inspectors of the bureau the year covered by the report was one of the most satisfactory of the past six years. Not since 1933 has the average number of defects per locomotive inspected been as low as it was last year. In 1933 there were 87,658 locomotives inspected, and 32,733 defects reported on the 8,388 locomotives that were found to be defective. In 1935 there were 94,151 locomotives inspected and 44,491 defects found on 11,071 locomotives. In 1938 the bureau's inspectors covered 105,186 locomotives and on 11,050 locomotives found to be defective there were 42,214 defects. During the last reported year the number of locomotives inspected reached the highest figure in recent years—5,153 more than during 1937—and, at the same time, there was a very substantial reduction in the number of defective locomotives and the number of defects found. The fact that 7,532 fewer defects were found than in 1937 is an encouraging indication that, even with the curtailment of expenditures for maintenance that had of necessity to be made as a result of reduced earnings, an increasingly high standard of maintenance had been set.

It would be natural to expect that the movement of heavier trains, in both passenger and freight service, at constantly increasing speeds would impose upon the many parts of a locomotive a burden that might result in a greater number of failures of such parts. There is a certain amount of satisfaction in knowing that the many improvements in the character of materials, the changes that have taken place in shop and enginehouse practice and the continued efforts of the mechanical-department personnel to improve an already good record for safe and efficient operation of motive power have borne fruit.

Aside from these facts there is also the factor of the cost of maintenance. For several years the more progressive mechanical officers have been preaching the value of preventive maintenance. The experience of most roads has proved this value. So, therefore, the records of federal inspection take on additional significance when it is realized that any substantial reduction in the number of defects found on locomotives is a certain indication that the factors which contribute to high repair costs and expensive road delays are being held in control.

The establishment of unusual records in any field of endeavor imposes upon us the necessity of greater effort in order to equal and surpass the existing records. What has been accomplished in the past six years has been under exceptionally unfavorable conditions. To improve in the future is going to require more than ordinary improvements in the facilities used in repair work. This is a factor that should be considered now while traffic is still below normal.

The Patent Problem

The Temporary National Economic Committee, familiarly spoken of in the newspapers as the monopoly investigating committee, devoted one of its early hearings to the patent question. Doubtless there may be certain features of our patent laws which, in the interests of fairness, should be revised. Anyone, however, who has had close contact with the railway mechanical department over several decades can recognize the necessity of affording protection to inventors.

Here, for instance, is a meritorious improvement which an ingenious inventor has developed after much study and experiment, usually on his own time and aside from his regular duties. Indeed, in many instances he is not even a railway employee. Eventually he may secure a patent for his device, but it is then only just started on its way. In most cases it is extremely difficult to find anyone who will try it out in practical service and then it may prove to be inadequate in some respects, or it may even fail abjectly, in spite of the fact that the idea may appeal to the practical railroaders who are conducting the test. More time and thought and expense must then be given to improving it, in order successfully to meet the requirements. In many instances the perfection of a device of this

kind has required several years of painstaking effort.

Even after the device has proved successful in service, however, it is a difficult task to get the railroads to use it, or to dispose of it to some person or company who can successfully merchandise it. If the inventor is not afforded reasonable protection he may stand to lose everything if, when the device has become serviceable, some shrewd person or company steps in and starts to manufacture and sell it; indeed some of them have enough trouble, as it is, to prevent chiseling.

Most inventors would not gamble on developing and perfecting a new invention unless they felt they had a reasonable chance of cashing in on it. Many of them might not do so anyway, if they realized the long and hard road that lay before them in perfecting and merchandising their inventions. Unfortunately, also, only a very small percentage of such people actually do profit to any considerable extent from their efforts.

Certainly society cannot afford to discourage invention. Kenneth H. Condit, assistant to the president of the National Industrial Conference Board, at a recent public forum under the direction of the American Engineering Council, in speaking on the social and industrial values of invention, pointed out that, "Our whole livelihood and standard of living is based on inventions. It may be that mechanical invention has outrun social invention, but so long as we can keep alive within us the spirit of invention our chances for survival as a nation are bright."

Harry H. Semmes, chairman of the patents committee of the American Bar Association, in speaking on economic aspects of the patent survey at the same forum, stressed the importance of inventions in another way. "America," he said, "has grown in the past largely by reason of the impetus given to the American life by three frontiers—first, the frontier of new land; second, the frontier of new people resulting from a rapidly increasing population; and, third, the frontier of new inventions creating new wants in mankind, and new industries to supply these wants. The first frontier of new land is gone. It has been estimated that the population will be stable by approximately 1950, and will shrink thereafter. We can no longer rely on the frontier of rising population. This leaves as the last frontier the frontier of research, new discoveries, new inventions, new industries. This frontier need never be closed."

Referring to the patent system, he said, "It is a good system. It has brought America far. If any real abuses are prevalent let them be aired, but let us make certain that these abuses constitute a real problem. Don't burn down the house to get the rats." Indeed, Mr. Semmes went so far as to indicate that it might be well to consider encouraging investment during the early stages of enterprise based on patents. He even suggested that "something might be done along the lines of remission of taxes for the first few years of a venture built on patents, or some other stimulus might be used to help the patent system expand the one remaining frontier; the frontier of human wants."

New Books

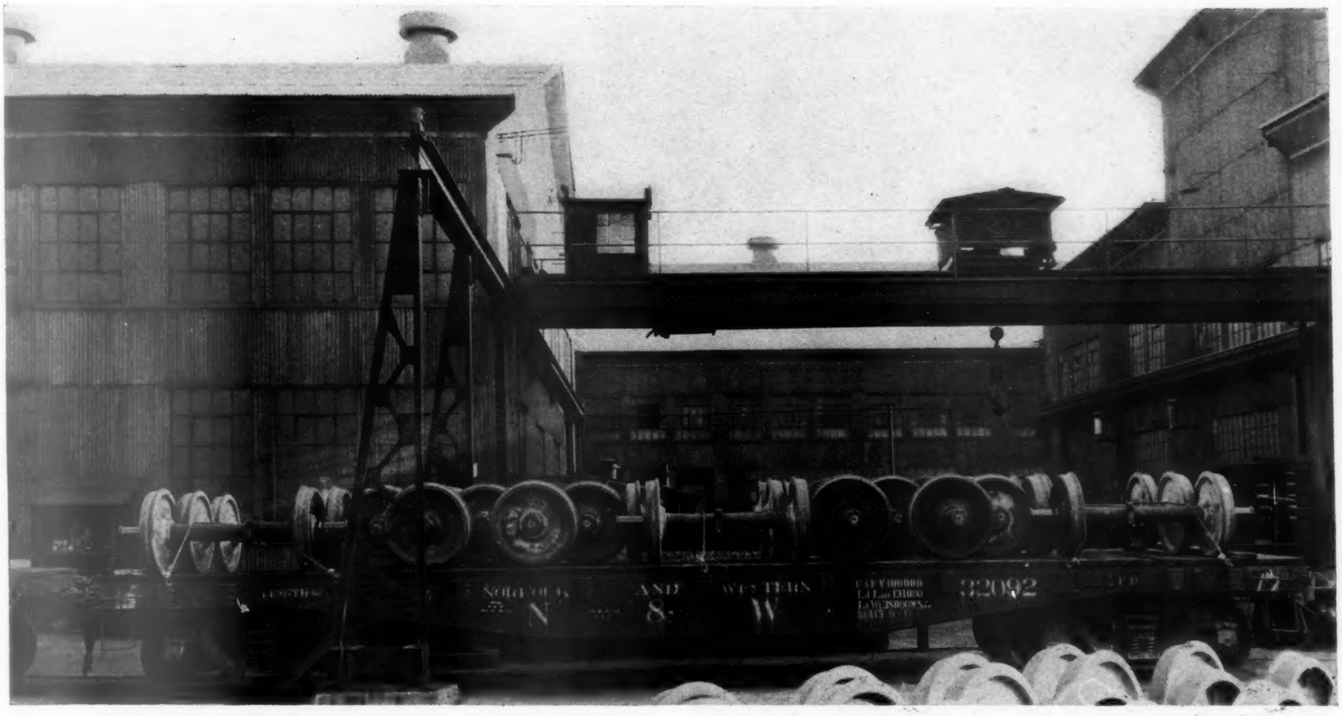
MANUAL OF ORDINANCES AND REQUIREMENTS IN THE INTEREST OF AIR POLLUTION, SMOKE ELIMINATION, FUEL COMBUSTION. *Published under the auspices of the Smoke Prevention Association, City Hall Square building, Chicago. Price, 50 cents.*

In addition to the prepared papers which were read before the thirty-second annual convention of the Smoke Prevention Association held at Nashville, Tenn., May 17-20, 1938, the manual contains a large amount of information pertaining to smoke prevention, methods of grading the density of smoke emission and dust fall, as well as the methods of analysis for oxides of sulphur, a digest of smoke ordinances of 80 cities and smoke districts and instructions for proper firing of various types of furnaces and fuels. Most of the data pertain to heating installations and stationary power plants. In the proceedings of the recent meeting of the association, however, are several papers bearing on railway smoke prevention. These are: Selection of Fuel for Use on Railroad Locomotives, by John C. Lewis, road foreman of engines, R. F. & P.; Elimination of Smoke by Proper Handling and Firing of Steam Locomotives, by J. P. Morris, mechanical superintendent, A. T. & S. F., and What the Locomotive Brick Arch Does Towards Smoke Prevention and Fuel Conservation, by Thomas F. Kilcoyne, American Arch Company.

PROCEEDINGS MASTER BOILER MAKERS' ASSOCIATION. *Albert F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y. Price, $3.*

The Official Proceedings of the 1938 Annual Business Meeting of the Master Boiler Makers' Association, held at the Hotel Sherman, Chicago, September 27, 1938, contains reports on seven topics: Topic No. 1—What means can or have been suggested to improve circulatory and other conditions in the locomotive boiler to eliminate leaky stays and cracked side sheets?; Topic No. 2—Honeycombing and slagging of flues and tubes, its cause and prevention; Topic No. 3—Which type of application of waist-bearer angles or tees gives the least trouble; Topic No. 4—Pitting and corrosion of locomotive boilers and tenders; Topic No. 5—Prevention of cinder cutting of flues and tubes, firebox sheets, steam pipes, etc.; Topic No. 6—What can be done to overcome the cracking of outside throat sheets?; Topic No. 7—In the application of flexible staybolts to boilers, which method gives the best results? (A) Screw the bolt up to a decided seat in the sleeve, cut to length and head over the bolt on the firebox end. (B) Screw the bolt up to a decided seat in the sleeve and then turn back one-quarter turn before cutting to length and heading bolt over on the firebox end. Topic No. 8 lists the subjects for 1939 discussion. The proceedings also contain a list of the members in attendance at the 1938 meeting, the Constitution and By-Laws of the association, and membership lists.

With the Car Foremen and Inspectors



Wheel Work at the Roanoke Car Shops*

By G. F. McFadden†

On the Norfolk & Western the principal wheel repair work is done at the Roanoke, Va., and Portsmouth, Ohio, shops, for the eastern and western general divisions of the railroad, respectively. Each shop has facilities for stripping, mounting and boring wheels, turning and burnishing axles and turning wheels and tires for freight and passenger cars and for locomotive tenders.

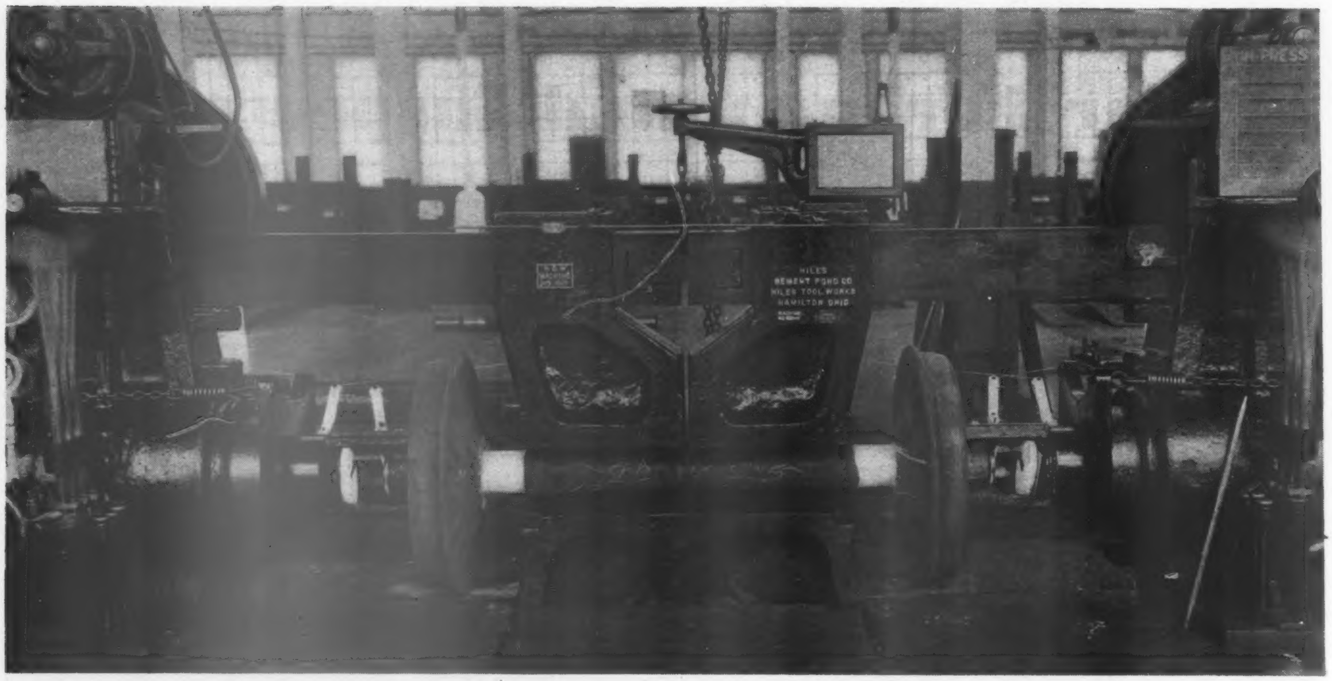
Wheels, which are shipped in to Roanoke from the various points are received on the service track (known as the loading and unloading track) and unloaded by means of an overhead crane, after which the wheels are inspected for defects. Under this overhead crane are tracks leading to the dismantling press and journal truing lathes. Each of the tracks is long enough to hold 30 pairs of wheels. The journal truing lathe also has an outgoing track as well as an incoming track to take care of wheels after they have been turned and burnished.

Multiple-wear wrought-steel wheels are handled to and from the wheel lathes through sliding doors back of the machines with ample space on the outside of the shop to take care of wheels that are to be turned, as well as those that have been turned.

The axle lathes are installed parallel with the building with enough space for the operator to move freely between the machine and the building and with ample aisle space to handle the axles to and from the machines. Two sets of cradles in front of each axle lathe are for axles. One set is for the axle that is waiting to be machined, while the other set is to take care of the axle when it is finished and removed from the machine. The axle to be machined is placed in the lathe before the axle that has been finished is removed from the cradle to the axle rack. These cradles will prevent the axles from damaging the floor.

One of the illustrations shows the position of the car-wheel boring mills. In front of these machines is space to take care of wheels to be bored as well as wheels that have been bored. All of the boring mill chucks equalize and are equipped with hardened adjustable jaws and are operated by automatic control. In order to determine whether or not the boring mills are boring a wheel concentric to the tread, a tram plate is placed on the mill table on tram blocks of the same height. This tram plate is perfectly round and has a hole in the center concentric to the outside of the plate. The jaws are closed on this plate in the same manner in which a wheel should be chucked, an indicator is placed in the boring bar and while the machine is in motion, it will show the amount that the hole in the center of the tram plate is eccentric. After it has been determined which jaws are responsible for the hole in the center of the tram plate being eccentric, it is corrected by releasing the jaws from the tram plate and placing or removing shims behind the jaws on the chucks sufficient to shift the center of the plate in line with the boring bar. This is done with a quick-adjusting jaw and shims. If the jaws are worn, they

* Reprinted, in part, from the Norfolk & Western Magazine.
† Foreman, Wheel Shop, Roanoke, Va.



The hydraulic mounting press ready to apply a pair of wheels

Wheel loading device, showing method of adjusting cables

should be surface-ground on the top and face to the same thickness, the face having a 1-in-20 taper.

In addition to boring the wheel concentric with the tread, it is also important to have the top of the jaws the same height from the table. This condition is corrected by means of a holder in one of the tool spaces and grinding the top of the jaws off with a portable grinder while the table is in motion. This method of grinding will allow all the wheels to lay level, provided the flanges have the same thickness on the front side. To insure that the wheels are chucked level, a surface gage should be used on the back rim of the wheel.

The wheel-mounting press is equipped with recording devices. The latter operates automatically and simultaneously with the gage, furnishing a continuous recording chart and diagram of each pressure application. This recording device can be applied to either a single- or double-end wheel press, and when mounting wheels simultaneously, the recording gages will only record the pressure for the side to which it is attached. These recording attachments are accurate, durable and in every respect dependable, and can be adjusted quickly for different size wheels without removing the attachments from the shoes. A recorder and attachments increase production from the boring mills and mounting press as they keep the supervisor informed as to just how the wheels are being bored and mounted. If the chart shows more than the maximum pressure, the tolerance can be lowered, or, if it shows less than the minimum pressure, the tolerance can be raised. These attachments also show the condition of the wheel fits and how the

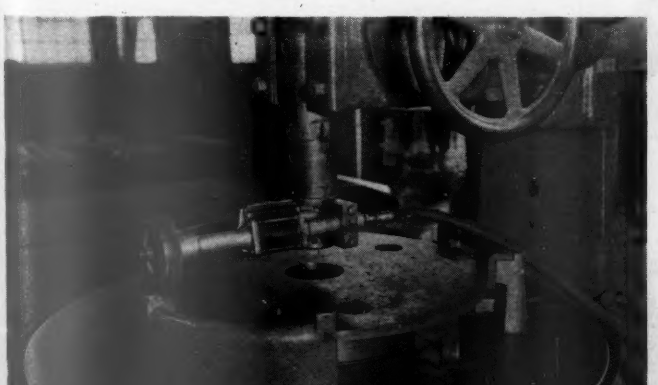
Indicator set-up for determining concentricity of wheel bores

The axles lathe group—cradles for two axles in front of each lathe

wheel-press operator is lining up the wheels with the axle seat to prevent scoring. The recorder and attachments increase production since they keep the lathe and boring-mill operators in touch with their work while they are doing it.

The method, which originated and was recently adopted on the Norfolk & Western, for loading mounted car wheels and the quick adjusting device used for lengthening or shortening the cables to take care of different size wheels are shown in the illustrations. Scrap ¾-in. cable is used. This method of blocking wheels eliminates the use of wooden wedges and the wheels are secured to the car with much more rolling resistance than the old method of loading wheels crosswise on a car. There is not only a considerable saving in purchasing lumber for wooden wedges, but in using this method of loading wheels, the parts used for loading a carload of wheels from Roanoke to an outlying shop are later used at the outlying point to ship wheels back to Roanoke shops. The anchoring of these wheels is done entirely from the side pockets on the car.

A battery of wheel boring mills



Tram plate jaws are ground with a portable grinder on the bar

The Roanoke wheel shop is equipped with three overhead cranes, one operating inside the shop and one at each end on the outside. The equipment also consists of two monorail electric hoists over the wheel presses, four axle lathes, two journal-truing gap lathes, two 42-in. car-wheel tire lathes, four car-wheel boring mills and two 600-ton wheel presses. Both presses can be fitted to strip or mount wheels.

All of the machines in this shop are so arranged that the wheels can be handled without congestion among the different machines, as all of the work is handled to and from the machines from the outside through sliding

The car wheel turning lathe

doors, using the outside instead of the inside of the shop for storage. In no case is it necessary for a pair of wheels to travel through the shop to get to the various machines.

Freight Car Dismantling Methods on the Rock Island

The Chicago, Rock Island & Pacific is carrying on a large junking program which is eliminating obsolete rolling stock and at the same time contributing substantially to the funds from which the new work is being financed. In two years the railroad has dismantled 5,800 freight cars and, with the moderate recovery of scrap prices, is now wrecking equipment at the rate of 200 freight cars and 15 locomotives a month—and incidentally getting a good price for old car bodies.

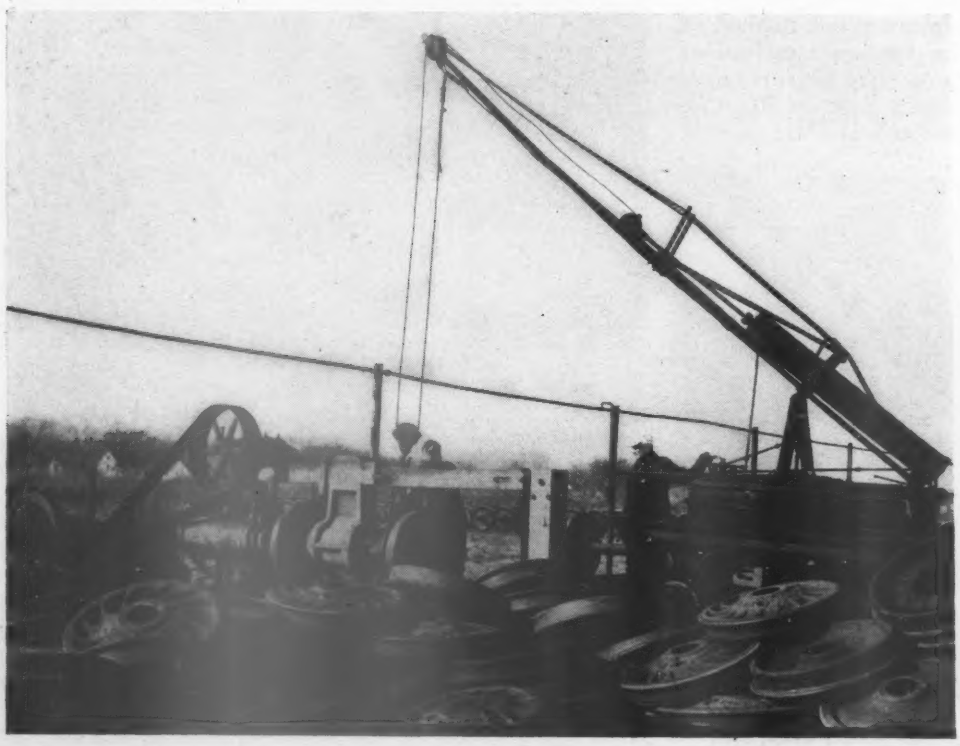
Dismantling Centralized

The dismantling plan has been to bring to Silvis, Ill., all condemned locomotives and all condemned cars in rolling condition. Chicago, 174 miles distant, is the railroad's best scrap market and Silvis is the location of the general store and main shops of the railroad where equipment can be dismantled and prepared for sale with the least rehandling and where recovered material can be prepared and redistributed most economically.

A schedule specifies the maximum expenditure permitted to put each class and series of equipment in condition for first class service at any one shopping. The figure is exclusive of wheels, couplers, trucks and body bolsters, draft gear and truck parts. Expenditures for running repairs are permitted up to 10 per cent of the standard maximum. The limit is $50 on some cars, $100 on other cars and $200 on still other cars, and $2,000 to $10,000 on locomotives. A uniform schedule

Car bodies stripped for truck mounting in the dismantling yard

of material prices, including shop and stores expense, is prescribed for estimating expenditures. Where the cost of repairs exceeds the allowable limit the cars are set aside for final inspection, following which they are properly labelled and placed in the rear of trains for



Diesel-engine-driven wheel press and air hoist used in dismounting and handling car wheels and axles

movement to the dismantling point. In this movement they are loaded with company material whenever practical. Equipment that cannot be moved is dismantled locally and the scrap shipped to Silvis for further handling.

Sell Car Bodies

The territory through which the railroad operates is largely agricultural and, from the outset of the dismantling program, box car bodies in reasonably good repair have been in demand, especially by farmers for use in building barns and even houses, and also for storing grain until the prices return to a parity with the prices guaranteed by the government to farmers who subscribed to the government crop control scheme or until the government takes the corn in payment of the loans. In the case of corn, these loans amount to 50 cents or more per bushel which is more than $150 more per car load than the farmers can sell it for at present prices. To meet this demand, the railroad has been selling the car bodies at prices ranging from $25 to $50 each and disposed of 770 car bodies in this manner in 1938. This year the sales at Silvis are made to contractors who truck the ready-made building over the highway for distances up to 100 miles.

All condemned box cars reaching Silvis with salable bodies are set on tracks in the car repair yard which are accessible from the highway. Car repairers, equipped with portable acetylene outfits, cut the bodies loose from the underframes and strip off grab irons, brake staffs and other fastenings. The drivers and helpers of several

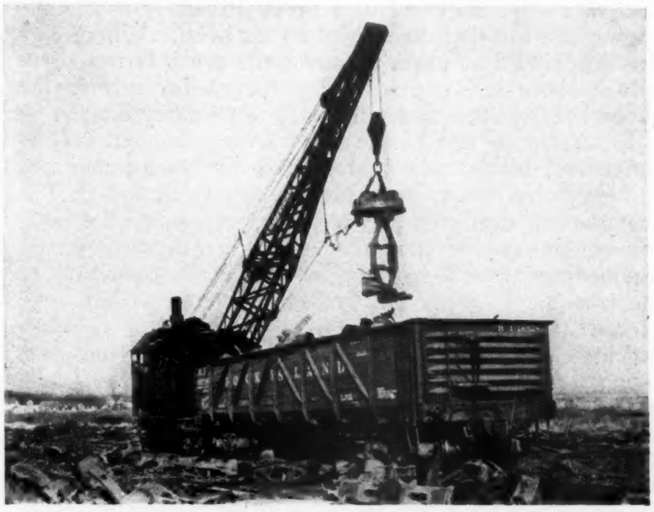
Two car bodies ready for movement over the highways on special truck equipment

trucks then help each other remove the bodies. They raise the bodies off the trucks one at a time, push the underframe in the clear and place trailer wheels in position under one end of the car body. A truck is then backed crosswise under the other end, and the body pulled into the clear, whereupon the truck, equipped with a swivel center plate, is swung into position in front of the car body and made fast to the tongue of the trailer wheels, and the car body is ready for the road. At outlying points, the metal on the bodies is detached and loaded by the purchasers, who are usually farmers.

Special Yard for Cars

In addition to these cars, other cars are set aside and the inside sheathing removed for further use by the railroad. All other box cars received at Silvis and all cars from which the bodies have been removed at Silvis, are switched into the car-dismantling yard where the wood bodies are burned and the underframes and trucks are reduced to scrap and salvage.

This yard was previously laid out for storing coal. While approximately one-half mile distant by rail from the system's scrap-handling facilities and material storage yards, it is free from fire hazards and has four spur tracks, each approximately 1,000 ft. long, which are ar-



The crane in the car dismantling yard operates a 42-in. magnet

ranged in pairs so that alternate tracks can be used for loading. The yard has approximately 2,000 ft. of underground oxygen and acetylene lines which are connected with an overhead extension from the Air-Reduction-equipped central distributing plant near the shops. This reduces both the expense of gas and the handling of gas cylinders. The yard has a steam locomotive crane of 25 tons capacity, operating a 40-ft. boom and a 42-in. magnet, also a press for dismounting wheels and two air hoists for handling wheels.

The yard is operated jointly by mechanical and store forces. The mechanical forces, in keeping with shop craft agreements, perform all dismantling, which includes setting off the car bodies and removing couplers, brake beams, brake cylinders, brake masts, grab irons, etc. Store-department forces prepare the scrap for sale and recover any reclaimable materials.

From 10 to 20 cars are demolished at one time. Cars with wood bodies are usually set off on the burning track

Cost of Car Dismantling in 1937

Labor for dismantling	$12,333.79
Handling good material	3,072.56
Cutting scrap	16,161.45
Miscellaneous labor	1,388.20
Supervision, local	3,114.67
Loading scrap	6,185.55
Oxygen and acetylene	15,377.48
Tools and lubricants	928.33
Running repairs to cranes, etc.	454.88
Fuel, light, heat, power, air, water	2.118.57
Switching charges	2,075.31
Total	$63,210.79
Weight	44,217 tons
Cost per ton	1.429

in the afternoon and the bodies are burned at night so that the metal will cool by the next morning. Most of the scrap is reduced to heavy melting steel, which reduces to a minimum the amount of sorting required in handling. During the cutting operation the metal from bodies, frames and trucks, with the exception of wheels,

is practically all left by the men where it falls. The crane operator has the run of one track in each pair and when not engaged in setting off cars for burning, alternately picks up each grade of material and loads it into cars. With the magnet it is possible to segregate the scrap and to salvage from the scrap with little assistance from ground men.

Cars loaded with scrap are weighed out for direct shipment on sale orders. Good wheels on axles are loaded for direct shipment to outside points while scrap wheels on axles are run to the end of one of the tracks where the wheels are removed in a press driven by a gasoline engine and are then loaded by an air hoist. Where cars are dismantled at outside points, the scrap is moved to Silvis where it is sorted and prepared for sale in the general scrap dock under three 10-ton Gantry cranes.

Referring to one of the illustrations, the general arrangement of the wheel press and air hoist mentioned as being used in handling car wheels, is illustrated. The press is of the single-acting type, being located at a convenient place in the yard where mounted car wheels can be readily rolled to the press for the removing of the wheels. The press is belt-driven from a Fairbanks Morse 10-hp. type-Y semi-Diesel engine. The air hoist and light truss-type boom are mounted on a derrick base supported on wheels which permit limited cross travel on rails. Operation of the air hoist, cable and crane hook permits raising and lowering car wheels as required in dismounting and moving them out of the way of the press. The air hoist is swiveled by hand pressure on a long pipe handle shown in front of the operator, whose hand is on the air valve used in operating the hoist. This hoist has proved to be a great labor saver in loading car wheels and axles in cars for final disposition.

Questions and Answers On the AB Brake

Brake Cylinders (Continued)

365—*Q.—What will cause a blow at the brake-cylinder exhaust port in the service lap position?* A.—Leakage past the release insuring valve, the service slide valve or the service portion cover gasket.

366—*Q.—What will cause a blow at the emergency portion exhaust in the service lap position?* A.—Leakage past the vent valve, the emergency graduating valve, the emergency slide valve or the emergency portion cover gasket.

367—*Q.—What will cause a blow at the quick-service exhaust in the emergency position?* A.—A leaking graduating valve, a service slide valve, or a service portion cover gasket.

368—*Q.—What will cause a blow at the brake-cylinder exhaust in emergency position?* A.—Leakage past the service slide valve, release insuring valve, or service portion gasket.

369—*Q.—What will cause a blow at the emergency portion exhaust in emergency position?* A.—Leakage past the emergency slide valve, emergency portion cover gasket, timing valve diaphragm, accelerated emergency release piston seal, spill over check valve, or emergency portion slide valve strut diaphragm.

370—*Q.—Can the brakes be released with a train of AB equipment immediately after an emergency application?* A.—No.

371—*Q.—How much time should be allowed?* A.—Approximately 2 min.

372—*Q.—In the event of a brake stuck or overcharged how would you effect a release?* A.—Move the release rod part way, in order to reduce the auxiliary reservoir pressure.

373—*Q.—In case of a defective brake, how would you operate the release rod?* A.—Move the rod a full stroke in order to bleed the auxiliary and emergency reservoirs.

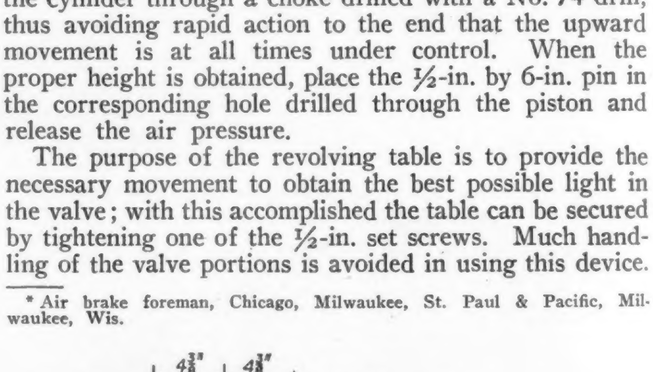
Device for Holding Universal Valves

By T. H. Birch*

The bulk and weight of the three portions of a universal air brake valve are such that it is a problem to hold them properly during the operation of cleaning and repairing. A practical device for this purpose has been designed for use in the air-brake department of the Milwaukee shops. This is shown in the accompanying drawing. A conventional 8-in. by 12-in. brake cylinder is supported from the under side of the work bench and in the end of the hollow piston sleeve a revolving table is applied. The valve portion is placed on the table and securely held with the two clamp-and-wing nuts. The desired height is obtained by introducing air pressure into the cylinder through a choke drilled with a No. 74 drill, thus avoiding rapid action to the end that the upward movement is at all times under control. When the proper height is obtained, place the ½-in. by 6-in. pin in the corresponding hole drilled through the piston and release the air pressure.

The purpose of the revolving table is to provide the necessary movement to obtain the best possible light in the valve; with this accomplished the table can be secured by tightening one of the ½-in. set screws. Much handling of the valve portions is avoided in using this device.

* Air brake foreman, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.



Adjustable holding device for universal valves used at the Milwaukee shops

IN THE BACK SHOP AND ENGINEHOUSE

Railroad Applications of The Metal-Spray Process

During the past year an effort was made to ascertain the extent to which metal spraying is applicable to repair problems in railroad shops. It has been a known fact for years that metal can be sprayed on various surfaces and has been extensively used in many industries for building up worn surfaces as well as for applying metal to others subject to corrosion. Although a number of railroads have made some use of the metal-spray process, some have discontinued its use while one or two others have been unusually successful with it. One railroad in particular uses this process successfully, and has found that there is a definite field wherein certain mechanical problems can be most satisfactorily solved with metal spraying. The following outlines the operations necessary for standard proved applications which have been found both successful and economical.

The Metal-Spray Process

A lightweight portable metal-spray gun, which may be fixed in any position is employed. As shown in Fig. 1, metal wire, oxygen, acetylene and compressed air are supplied to the nozzle tip of the gun. A compressed-air turbine propels a series of speed-reducing gears which feed the metal wire at uniform speed into and through the nozzle. At the tip of this nozzle an oxyacetylene flame melts the metal wire and compressed air atomizes the molten metal, blowing the resultant metal spray upon a surface which has been properly processed beforehand by cleaning and roughening. The metal can be sprayed until the built-up surface reaches any desired thickness.

The proper preparation of the base metal results in a foundation that enables the sprayed deposition to "key" itself to the parent body; therefore, the adherence is due to its "mechanical bond." To obtain this bond, flat surfaces are blasted with angular steel grit, sharp Cape May sand, or Joplin grit, since sharp cutting edges must be employed. When blasting, the blast nozzle is held at different angles to the surface to develop undercut caves and overhanging crags, which act as keys and anchorage for the new built-up slab of metal. Due to the high air pressure used in blast cleaning, both sand and steel grit penetrate into every crevice, and deeply score most surfaces; therefore, areas not intended to be metal sprayed are shielded with a rubber adhesive tape or cloth similar to that used by stone cutters. Shafts are shielded with friction tape.

A second method, threading, is also used for preparing surfaces for metal spraying. This method consists of threading the part to be metal sprayed and then removing the top of the threads with a flat-nosed tool.

When building up surfaces, it is almost always necessary to undercut the surface to be built up, both in order to have the correct thickness of sprayed metal on the finished job and in order to dovetail or key the ends of the coating. The amount which the work should be undercut is determined by (1) the size of the shaft and (2) the amount of wear to which it is to be subjected in service.

When surfaces have been prepared for metal spraying they must be kept clean from grease or dirt, and should not be handled with the hands. When necessary to handle, clean white cotton gloves should be used. Not more than eight hours should be allowed to elapse between the blasting operation and the metal-spraying operation in clear weather, and not more than two hours in damp weather; otherwise, oxidation will partially

Locomotive Parts Which Are Being Metal Sprayed Successfully

Duplex stoker elevator bushing.
Alco reverse-gear valve stem.
Precision reverse-gear screw, sleeve, shaft and trunk.
Locomotive piston rod.
Air-compressor-governor valve stem.
8½-in. air-compressor piston rod.
Worthington feedwater-heater bucket spindle and piston-rod tubing.
Elesco feedwater-pump piston rod.
Elesco exhaust steam injector water valve, piston stem, main steam nozzle, and overflow plates.

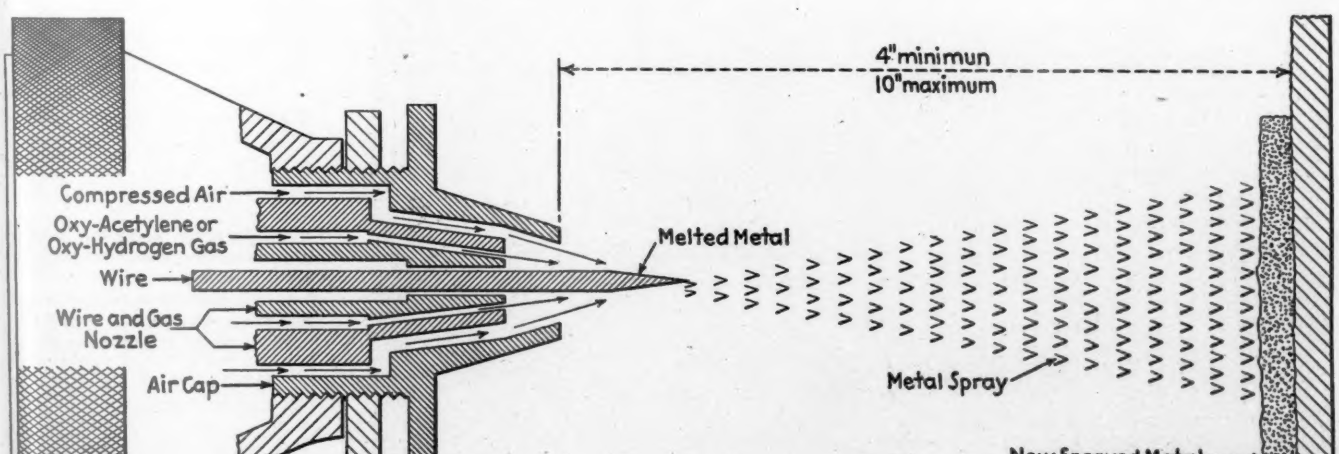


Fig. 1—Cross-section of the wire nozzle and air gap of a metal-spray gun

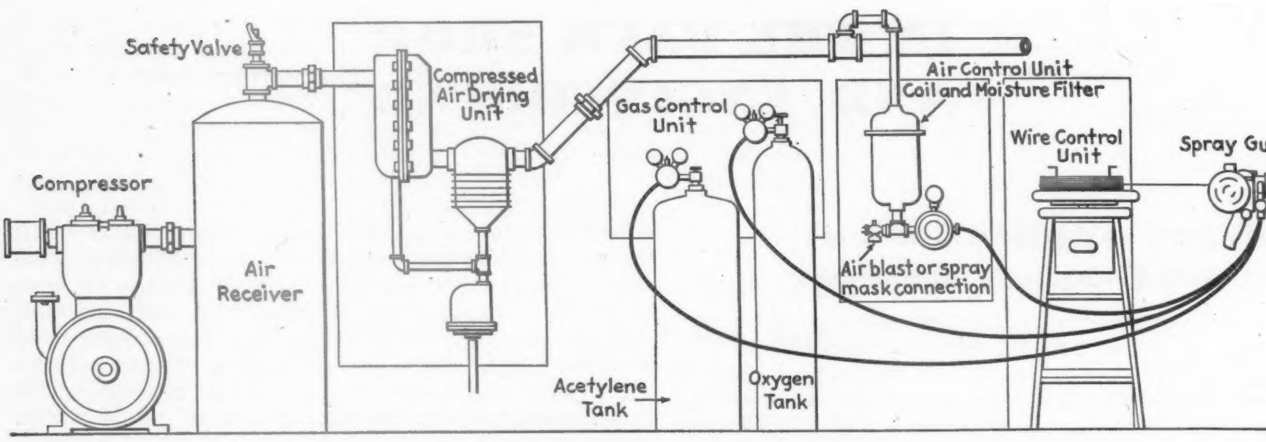


Fig. 2—Layout of equipment essential for successful metal spraying

destroy the ability of the new metal to bind to the base. Blasting is never conducted outside in damp or wet weather.

Fig. 2 shows the equipment necessary for the proper operation of the process. All of the parts shown are absolutely essential for successful metal spraying, and most failures can be attributed to lack of understanding of the various units involved. As will be noted, much of the equipment furnishes clean, dry, compressed air free from moisture and oil, which is a prime necessity. Wherever the climate or shop conditions are such that the air is damp or hot, condensed water in the compressed air supply will be an unending source of trouble unless it is eliminated. Likewise, worn compressors will pump an excessive amount of oil into the compressed-air line which must be removed before it reaches the gun. Such oil, as well as excessive moisture, is removed by a filter, which is part of the air-control unit shown in Fig. 2. The filter should be removed periodically, the length of use depending upon operating conditions.

The structure of sprayed metal is quite different from that found in cast, rolled or drawn metals. As the small molten particles are sprayed from the gun they strike the surface, where they flatten out, and cool almost instantly. Thus, a stratified metal structure of small flattened, interlocking, metal particles is built up, which is partly pervious due to the presence of slight amounts of oxide and absorbed gases.

This peculiar structure results in a change of physical characteristics of the metal. The ductility, elongation and tensile strength of sprayed metal are greatly reduced, when compared with the same metal in the cast form. On the other hand, the qualities of compression, wear resistance, corrosion resistance, hardness, heat and electrical conductivity remain virtually unchanged in so far as the practical uses of the process are concerned.

The metallizing process should not be used on applications where the sprayed metal will be subjected to sharp impact, continued pounding at one point, or severe edge strain. The process is, however, entirely satisfactory for use on surfaces where there is full-bearing contact rather than point contact.

Application of Metal Spraying in the Railroad Shop

The table shows various locomotive parts which are being metal sprayed successfully by a midwestern railroad. In addition, the metal-spray equipment located in the locomotive shop is used for metallizing miscellaneous passenger-car parts as well as parts of shop machinery. These include the following: drill-press spindle shafts; hydraulic-pump plungers; washout-pump piston rods; gear fits on all types of machine drive shafts; piston and valve rods for air compressors; rotor slip rings on shop-machinery motors; motor armature shafts and bearings; shafts and bearings of centrifugal pumps; fan-engine pis-

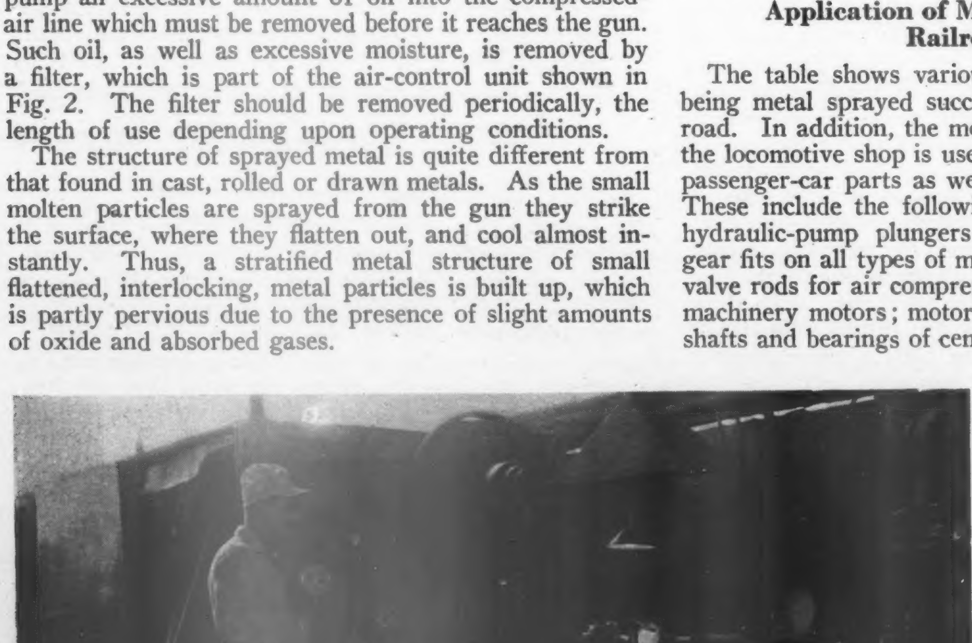


Fig. 3—Spraying tubing for Worthington feedwater-pump piston rods, which is reclaimed at 10 per cent of its original cost.—Note the exhaust hood above the lathe and the blasting cabinet behind the operator

ton rods; emery belt roller for flue polishers, and engine-lathe headstock drive spindles.

These parts represent but a few of the possible applications; however, these are mentioned because they have all been metal sprayed successfully and have been in service long enough to prove that the built-up surface gives a service life equivalent to, if not longer than, a new part or an old part built-up by welding.

In passing, it is of interest to note that the locomotive shop in question has on many occasions used its metal-spray equipment for metallizing parts sent to the shop by industrial concerns located in the same city. As a direct result of such work, seven of the city's largest industries have purchased and installed their own metallizing equipment as an aid to solving their shop maintenance problems.

All of the work here mentioned was done on the lathe and with accessory equipment shown in Fig. 3. There are three major operations involved in metallizing any of the parts: (1) Preparation of the surface to be metallized, (2) metal spraying, and (3) finishing.

The preparation of the surface to be metallized depends on the service to which the part in question is to be subjected. It may be set up in the lathe, undercut, dovetailed at the ends, and finally cleaned and roughened by blasting or rough turning. The size of the undercut depends on the extent to which the part has worn. Every part will wear a certain amount before it is either replaced or restored to size; this is termed "wear expectation." Regardless of what this wear may be, an additional under-thickness of sprayed metal must be added which is called the "minimum coat thickness" or "foundation." As a general rule, this foundation is 0.01 in. on the radius for a shaft 1 in. or less in diameter, and 0.005 in. of sprayed metal is added for each additional inch of diameter until a thickness of 0.04 in. foundation is reached. The wear allowance or wear expectation, the amount of metal which must be added to the minimum coat thickness to take care of the wear expected from service, is determined for each individual job and may vary from 0.001 in. to 0.250 in.

Whether or not the piece has been undercut, it is blasted or rough turned as described previously, with the various portions not to be metallized being protected by cloth or friction tape.

As shown in Fig. 3, the metal-spray gun is mounted on the tool post of the lathe and, after the flame and speed of the wire feed has been adjusted, the spray is directed on the work and the feed of the lathe carriage is locked. The speed of the work may vary up to 40 peripheral ft. per min., and the feed of the carriage is adjusted to a speed slow enough to provide a uniform application of the metal. The part should be sprayed evenly from right to left, or vice versa. The tip of the nozzle may be kept at a minimum of 4 in. or a maximum of 10 in. from the work. The speed and feed, as well as the distance of the nozzle tip from the work, varies for any given job. However, the exact value of these variables are not difficult to ascertain and considerable latitude in their adjustment is permissible with little effect on the finished product.

During spraying, the part should not be allowed to develop a temperature much greater than 250 deg. F., which is determinable by placing the back of the hand lightly against the work. If excessive temperatures develop, the part should be allowed to cool. Excessive heat may cause the metal to expand and pull away from the base, particularly when steels are being sprayed.

Finishing of the part may be either by wet grinding or machining. Grinding gives a better surface, and for the parts metallized in the shop in question grinding has been utilized almost exclusively.

Obviously, in this article only the fundamental features of metal spraying have been discussed. One fact cannot be overstressed; that is, the art of metal spraying requires extreme accuracy and care if it is to be successful. Also, no one should take it for granted that metal spraying is a simple process; it is a highly developed technique requiring much experience. Successful applications come only with a thorough knowledge of types of metal to use, the correct wire sizes, wire speeds, extension of the wire beyond the air gap in the nozzle, the correct air-gap setting, the pressures of oxygen, acetylene and air, the speed of the work in the lathe, the feed of the lathe carriage and the distance of the nozzle tip from the work.

After several years' experience, the shop wherein the work described in this article is being done has found that metal spraying can be successfully accomplished with gratifying economical results. For example, stoker elevator-shaft bushings are being reclaimed at 3 per cent of their original cost; main steam nozzles for Elesco exhaust-steam injectors are being reclaimed at 9 per cent of their original cost; overflow pistons for Elesco exhaust-steam injectors are being reclaimed at 20 per cent of their original cost, and tubing for Worthington feed-water-pump piston rods is being reclaimed at 10 per cent of its original cost. These parts, as well as many of the others previously mentioned, have given service equivalent to that of new parts, thus proving the adequacy of the mechanical bond effected by metallizing.

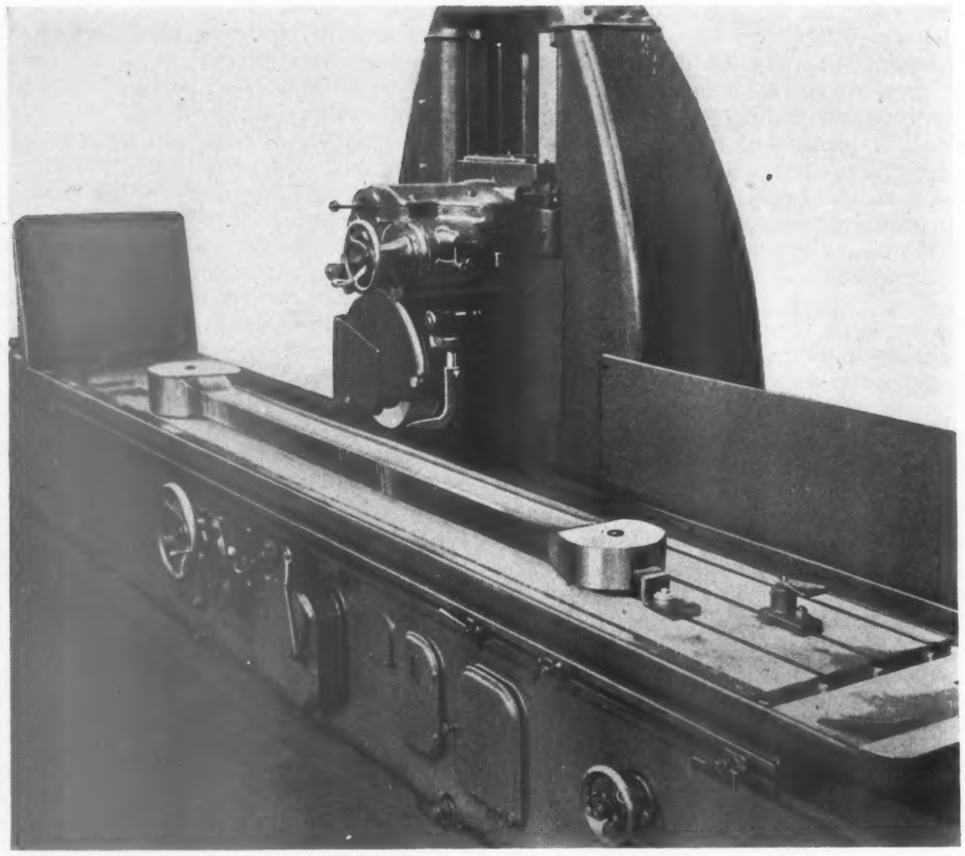
The successful application of metal spraying can only be obtained by a thorough knowledge of all the factors involved. The character of the part to be sprayed as a rule matters very little. However, each individual job must be studied carefully to determine whether or not service conditions to which it must be subjected will have no detrimental effect on surfaces bonded mechanically. It was apparent while making this study of metallizing in the railroad shop in question that its success has been due entirely to meticulous care and a thorough knowledge of the technique.

Precision Surface Grinding On a Large Scale

What is believed to be one of the largest precision surface grinders of its type ever built is the Mattison machine illustrated, which has a table capacity of 30 in. wide by 16 ft. long. The base length is 36 ft.; wheel clearance above table, 20 in. Being used in a railroad shop, it provides a table surface of sufficient size to accommodate large work which before could not be satisfactorily handled, and at the same time produces an accurate and fine finish. In addition, it permits grinding more pieces per set-up on regular sizes of work.

An outstanding characteristic of the Mattison surface grinder is the powerful built-in motor construction, with the rotor mounted directly on the wheel spindle and balanced as a unit. With this positive and direct form of drive, there is no vibration imparted to the wheel spindle, as may be the case with belts, chains, gears or other drive connections.

To remove successfully stock with a grinding wheel, it is also necessary to maintain full power. The instant the wheel slows down, due to slippage, cutting efficiency is lowered and capacity and quality suffer. On the surface grinder illustrated the motor delivers its full power direct to the wheel and there is plenty of reserve to insure full wheel speed for fast grinding.



Mattison 30-in. by 20-in. by 192-in. high-powered precision surface grinder

Other features of the machine are the double column mounting, hydraulic feeds and convenient operating controls. This type of machine is also supplied by the Mattison Machine Works, Rockford, Ill., with conventional table sizes from 12 in. by 36 in. up.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Cause of Wear of Exhaust Nozzle Bridge

Q.—We have a number of engines that had exhaust nozzles 6¾ in. in diameter, and single bars. We have changed the nozzle to 7 in. in diameter and are now using two bars. I notice since we made the change that the top of the two bars wear flat and the bottom that goes in the tip does not wear. These bars were diamond shaped when we put them in the tip. I would like to know why the top of these bars wears flat while the bottom doesn't.—B. C. H.

A.—The fact that the bars wear flat across the top would indicate the cause of the wearing is cinder cutting. Although the exhaust passes through the nozzle with considerable velocity, this does not necessarily indicate that the wear would take place at the bottom of the bars. It is not the exhaust steam, but rather the cinders passing over the tops of the bars which are cutting and wearing them flat.

The purpose of these bars is to increase the entraining area of the exhaust, that is, to spread the steam into segments, thereby giving a greater outside surface to the exhaust-steam jet when passing from the nozzle tip to the stack for sucking in the gases and cinders, thus making for a better draft.

As the exhaust steam passes these bars, the velocity of the steam causes a vacuum directly over the bar, due to the diamond-shaped bottom spreading the steam. When the steam is shut off, this vacuum is broken and the gases and cinders rush in to fill the vacuum causing a cinder-cutting action across the top of the bars.

Were the exhaust a constant flow, this condition would not exist, due to the fact that the vacuum would not be broken; however, with a locomotive the vacuum created by the exhaust over the bars is broken with each stroke of the piston, with the resultant cinder cutting eventually wearing the top of the bars flat.

Causes of Leaking Boiler-Check Studs

Q.—On our locomotives the boiler checks are located on the side of the boiler, the one on the right side being piped back to the injector, while the one on the left side is piped ahead to the feedwater heater. Considerable trouble is experienced with the check studs leaking. What causes this condition?—F. F.

A.—This condition is generally due to the difference between the expansion of the boiler and the expansion of the delivery pipe to the check valve. On the right

side, the injector is studded to the wrapper sheet and the check is studded to the boiler; therefore, the difference in the expansion of the boiler and the injector delivery pipe between these two points sets up a stress in the studs securing these parts. The delivery pipe stands away from the boiler, causing a moment arm on the studs securing the check to the boiler; hence, the continual working, due to expansion and contraction of the pipe, loosens the studs causing steam leaks.

Where there is considerable distance between the boiler check and the injector, and the pipe clamps securing the delivery pipe to the boiler are not clamped tight on the pipe, allowing the pipe to breathe, or where there is an offset in the pipe, which provides a place for the pipe to compensate for the unequal expansion and contraction, this condition is somewhat relieved. It can also be relieved by increasing the size of the studs securing the check to the boiler, giving a more rigid construction at this point.

This condition is generally not as severe on the feedwater-heater side, due to the fact that this pipe has a large bend where it goes up to the feedwater heater; however, care should be taken to prevent the pipe from being clamped tight in the clamps along the side of the boiler.

The Application of Aluminum Rivets

Q.—Should aluminum rivets be used in assembling aluminum parts such as cabs, rimboards, etc? Does the procedure for riveting aluminum parts vary to any great extent from that used in riveting the same parts made of steel?—B. B.

A.—Either steel or aluminum alloy rivets may be employed, steel rivets are stronger, but they should be used only when the parts are adequately painted. Aluminum-alloy rivets are employed where maximum resistance to corrosion and weight saving are essential.

Steel rivets in aluminum parts are applied in the same manner as for steel plates. They are heated to about 1,800 deg. F. and driven with as little delay as possible so as to make the driving easier. Where a large group of hot steel rivets occur closely spaced, it is good practice to avoid overheating the adjacent metal. This is usually done by driving the rivets at random rather than in succession. Sometimes it is necessary to cool the parts being riveted with water or compressed air. The temperature of the aluminum-alloy parts being riveted should never be allowed to rise above 300 to 400 deg. F., the exact temperature depending on the alloy.

The procedure for applying aluminum rivets in aluminum parts does not differ greatly from that used for steel rivets. Because the characteristics of the various materials used for the rivets differ, there is some difference in the driving methods employed for the rivets made from each of the aluminum alloys.

The properties of commercially aluminum rivets and some of the aluminum alloys are not improved by heat treatment and are always driven cold. Other aluminum alloys have their properties improved by heat treatment; consequently, rivets made from them should always be heat treated before or during the driving operations. For heat treating aluminum-alloy rivets, a reliable temperature indicator is essential in order to insure the required temperature control. When rivets are to be quenched in water for cold driving, the heating equipment generally consists of a bath of sodium nitrate heated by gas, oil or electricity. The rivets are handled in a basket made of wire mesh or perforated sheet and must be quenched quickly after removal from the heating bath. All nitrate must be washed off the rivets.

Aluminum-alloy rivets for hot driving are commonly heated in a load pot, or in an electrically heated air furnace. Automatic control of temperature is highly desirable in both types of equipment. The heating equipment must be near the work so that the temperature lost in transfer is minimized. When heating in a lead bath provision must be made to submerge the rivets in the bath; otherwise, they will float. All adhering lead should be removed by a sharp blow against some solid object, before the rivet is inserted in the hole.

In selecting the rivet alloy to be used it is good practice to use a rivet having about the same properties as the material in which it is driven.

In applying aluminum rivets, squeeze riveters are preferred, thus assuring properly upset shanks and well-centered heads. Pneumatic hammers are suitable for riveting aluminum-alloy rivets provided they are large enough to upset the rivets properly.

Aluminum-alloy rivets may be headed by means of a heavy hand hammer or sledge. This method has been found satisfactory for work which permits adequate bucking.

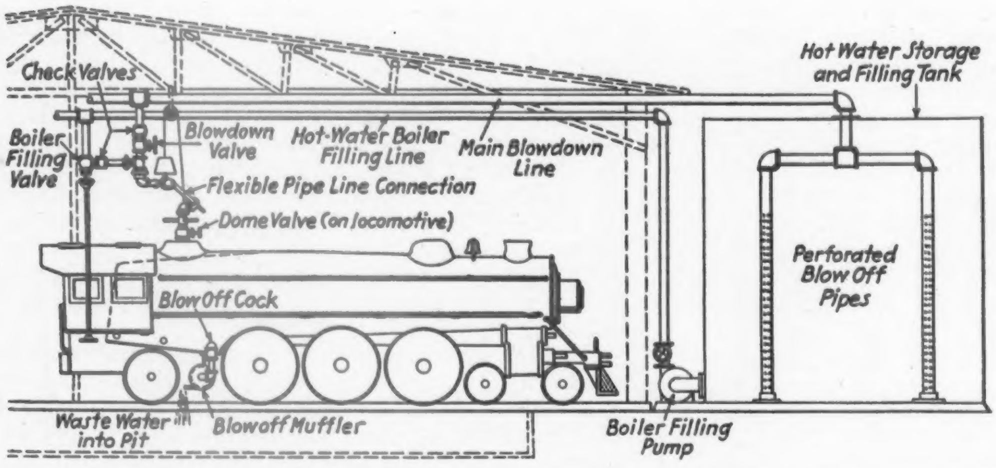
Rivet sets used for driving aluminum-alloy rivets should have smooth polished surfaces so that the metal will flow readily during the forming of the head. The bucking tools, especially those used with the large hammers, should have plenty of mass. The mass should be distributed close to the rivet head and be concentric with it. The cup on the bucking-up set should be slightly wider and shallower than the manufactured head so that the initial contact will be at the end of the head directly in line with the shank. This practice will prevent the shank from being driven up into the head and will greatly facilitate upsetting throughout the length of the shank.

Boilers Blown Down and Refilled Through Steam Dome

The Sturdevant system of reclaiming, washing, and filling locomotive boilers, illustrated in the drawing, was developed on the Southern Pacific by C. W. Sturdevant, assistant engineer of tests, San Francisco, Calif., and during the past few years it has been extended over the entire Pacific as well as Texas & Louisiana Lines of this company. Furthermore, since its initial use by the Southern Pacific it has been adopted and has been in use by the Western Pacific at all of their engine terminals.

This system is based upon the principle that the release of the steam from the boiler into a receiver at atmospheric pressure causes approximately one-third of the water in the boiler to be evaporated and carried over as steam and condensate into a main hot-water-storage tank as distilled water. Many tests of locomotives being serviced in enginehouses substantiate this large amount of pure water recovered. The system is immediately effective as soon as the locomotive is housed, the blowoff of the steam being quickly made from the locomotive steam dome at the top of the boiler through a flexible pipe conduit into a main overhead pipe line which leads into the reclamation receiver. Normal time of blowing down the boiler is about 45 minutes; however, the speed of blowdown may be varied by the control valve situated at the top of the steam dome and carried by the locomotive.

This method of blowing down the locomotive boiler



The Sturdevant system of reclaiming, washing and filling locomotive boilers

is particularly distinguished by the fact that the blowoff of the locomotive is made from the top of the boiler instead of through the blowoff cock. This prevents all sedimentary matter and foul water containing soluble salts from being discharged into heaters, pumps and pipe lines, thereby eliminating periodical cleaning of the system to rid it of objectionable extraneous matter and reducing the maintenance cost to a minimum. When the blowing off of the locomotive is completed and all pressure is out of the boiler, the remaining water in the legs and lower boiler portions is discharged through the blowoff cock or blowoff muffler into the locomotive pit. Washout plugs are then removed and the boiler washed, preferably with hot water from the main storage reclamation tank, although recovery of the waste water into the locomotive pit can, if desired, be made in a sump pit and used for washing purposes.

In washing boilers the temperature of the water on the discharge side of the washing pump is blended down to a temperature of approximately 120 deg. F., which is as hot as the boiler washers can handle it. After the boiler is washed, washout plugs replaced and the blowoff cock closed, the boiler is then filled with hot water from the main storage tank, at approximately 180 deg. F.

Filling of the boiler is made at the top of the boiler through the dome and by the same flexible pipe connections as previously used for blowing off the steam from the boiler, there being an arrangement of by-pass and shut-off valves, as shown in the drawing, which permits the hot boiler filling water to be discharged from the boiler filling pump through the enginehouse pipe line directly into the top of the boiler. In other words, the steam is removed from the boiler and hot water subsequently replaced in the boiler through the same connection at the top of the steam dome. This method of filling the boiler eliminates filling through the blowoff cock and does away with the blowoff hose and connections now commonly used for this purpose. Present enginehouse piping, with slight modifications, can be made to accommodate the Sturdevant system.

From the foregoing it will be obvious that the receiver into which the steam from the locomotive boiler or boilers is discharged also provides the hot-water storage from which they are refilled. The filling water in the receiver is of an excellent character, being composed of distilled water (condensate) from the initial blowoff of the locomotive and makeup water as may be required from the source of water supply.

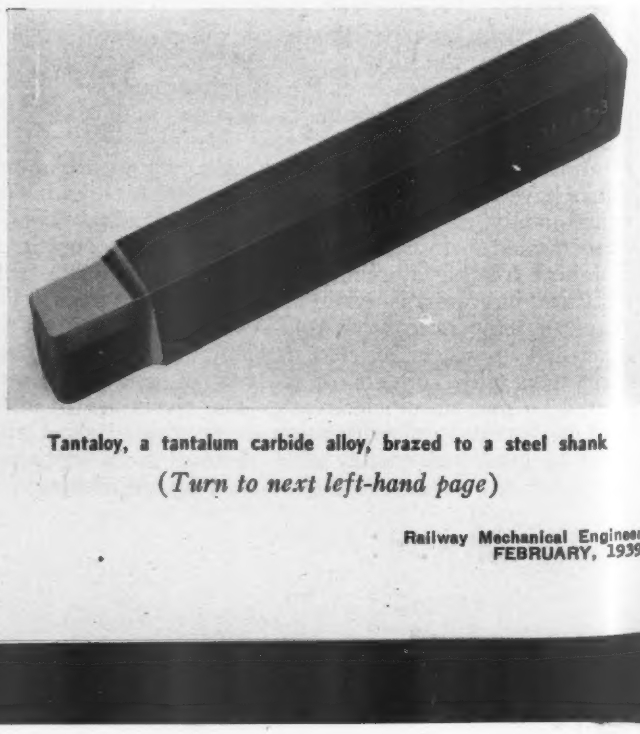
Another outstanding advantage is claimed for the Sturdevant system by reason of the removal of the steam before the removal of the water from the boiler, namely, the retention of the water in the legs of the firebox during the blowoff period. This permits the firebox sheets and staybolts to cool down gradually and without subjecting these highly-heated portions to rapid strains of expansion and contraction.

This arrangement described is being placed upon the market by J. C. Martin & Company, Engineers and Manufacturers, Los Angeles, Calif.

Tantalum-Carbide Alloy For Metal-Cutting Tools

The Fansteel Metallurgical Corporation, North Chicago, Ill., has developed a hard cutting-tool and wear-resisting alloy known as Tantaloy. It is a general-purpose hard metal ordinarily used as a tip which is brazed to a steel shank to form a cutting tool. Containing tanatalum carbide, Tantaloy is said to possess the characteristics of a high degree of chip slippage which resists the development of crater by the chip action. When regrinding, these tools require very little metal removal, thus decreasing the grinding time and increasing the useful life of the tool. An outstanding characteristic is toughness, making Tantaloy-tipped tools efficient for service ordinarily regarded as severe, such as interrupted cuts, heavy feeds, varying hardness of metal, or tool mounting essentially deficient in rigidity.

These tools are available in all standard lathe, boring-mill and turret tool sizes; also the metal is available in tips which may be brazed to boring bars, counterbores, or special tools. Tantaloy is recommended for gages, lathe center, centerless grinder rests, wearing surfaces, and the general field of application of abrasion- and corrosion-resisting metal.



Tantaloy, a tantalum carbide alloy, brazed to a steel shank

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Measured in rail miles, Chilled Car Wheels are 40% better today. Improvements in design, in manufacturing methods, and in control of operations in Member Plants have resulted in a steady increase of miles of service delivered by Chilled Car Wheels over a period of 10 years. But our aims are not yet fully attained. Research and careful inspection will go on to the end that, "Every wheel shall be as good as the Best," and the best shall be capable of still higher standards of performance.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

230 PARK AVENUE,
NEW YORK, N.Y.

445 N. SACRAMENTO BLVD.,
CHICAGO, ILL.

ORGANIZED TO ACHIEVE:
Uniform Specifications
Uniform Inspection
Uniform Product

High Spots in
Railway Affairs . . .

Lea's Bill In the House

Clarence F. Lea of California, chairman of the Committee on Interstate and Foreign Commerce of the House of Representatives, has introduced what is well designated as an omnibus bill. It is based largely on the reports of the Splawn-Eastman-Mahaffie Committee and the Committee-of-Six, and is apparently intended as something to "shoot at" in the attempt to draw out constructive recommendations from all interested parties through an extensive series of hearings begun in Washington on January 24. Chairman Lea has given much intelligent study and thought to the transportation problem while in Congress and can be depended upon to give real leadership to his committee. In opening the hearings he concluded with this statement: "This committee will, to the extent of its ability, prepare transportation legislation with a view of dealing justly with our various types of transportation; so far as there is a practical legislative remedy, endeavor to relieve the economic stress from which these agencies now suffer; and attempt to serve the public interest of the country by this legislation."

The Administration And the Railroads

Twice within a week, on January 16 and again on January 23, President Roosevelt held White House conferences to discuss the railroad problem, at which Senator Wheeler, chairman of the Senate Committee on Interstate Commerce, and Representative Lea, chairman of the House Committee on Interstate and Foreign Commerce, were present. Quite apparently the Administration is impressed with the necessity for really doing something with the railroad question at this session of the Congress. Representative Lea is already at work in the House, as indicated elsewhere in this column. At this writing it is not clear just what action Senator Wheeler and his committee will take. The Senator has indicated that he is not in "violent disagreement with the Lea Bill." From what he has said, it is quite likely that he will introduce bills in the Senate to reorganize the Interstate Commerce Commission and to give that body authority to regulate water carriers. It seems that he is still opposed to the repeal of the long-and-short-haul-clause of the Interstate Commerce Act's Fourth Section. In light of the performance of Senator Wheeler and his committee in the last Congress, it would appear that the House Committee will have to be the pace setter in any really worth while endeavor to enact a comprehensive and constructive legislative program.

R. B. A. for a Subsidy

Naturally the Railway Business Association, made up of members of the railway manufacturing and supply industry, is taking a keen interest in proposed legislation for the relief of the carriers; indeed, the welfare of its members depends upon railroad prosperity. Among other things, it believes that the present emergencies are so great that ordinary legislative action cannot bring relief soon enough, so that for a while at least, the railways, and particularly the weaker ones, should be given a subsidy in the interests of national defense. It suggests that the subsidy might well be based upon a certain proportion of railway expenditures for maintenance of way and structures during each year, beginning with 1939. It is estimated that such a subsidy might range between $100,000,000 and $200,000,000 a year, and might be continued for a limited period of from three to five years. The R. B. A. also believes that greater economies should be practised by the railroads and suggests that this can best be accomplished by a program which will permit orderly consolidations in such a way as to realize substantial operating economies.

Postalized Railroad Rates

Considerable furore has been stirred up by full-page advertisements in a few large daily newspapers, presenting the claims of the Hastings postalized rate plan. John A. Hastings, a former member of the New York State Senate, first made his proposal several years ago. In 1935 Chairman Wheeler of the Senate Committee on Interstate Commerce, asked Co-ordinator Eastman to give the matter consideration. The co-ordinator reported back to the senator that it would be well for Congress to direct the I. C. C. to study and report on all such plans. No action was taken by Congress. Mr. Hastings and his backers—whoever they may be and for whatever reason—have succeeded in stirring up Senator Wheeler again. Chairman Marion M. Caskie of the Interstate Commerce Commission, in replying to the senator, has again suggested the desirability of a mandate to the Commission from Congress, authorizing it to study the plan and report back. Briefly, the scheme divides the country into nine postalized fare regions, with a flat rate for passenger travel within any one region. That the scheme is considered experimental is indicated by the fact that the government is asked to guarantee the railroads against loss of passenger revenue. The plan also contemplates similar treatment of freight charges eventually. Railroad men do not favor the plan and the National Transportation Conference is quite definitely opposed to it.

Old Men Not Wanted on I. C. C.

An Interstate Commerce Commissioner is appointed for a term of seven years and until his successor is confirmed. Because of his action in criticizing the "nine old men" on the Supreme Court, President Roosevelt apparently has a problem on his hands with the I. C. C. commissioners. A year ago the terms of Frank McManamy and Charles D. Mahaffie expired. Mahaffie was reappointed, but McManamy, who will reach seventy in 1940, has been riding along since, no intimation having been given to the public by the President as to what action he may finally take. This year the terms of Balthasar H. Meyer and William E. Lee expired. The President has indicated his purpose to replace Meyer, who is 72 years old and is familiarly termed the "dean" of the Commission because of having served longer on it than any other commissioner in I. C. C. history. No action has yet been taken in the case of Lee, who is still in his fifties. He has been a member of Division V, the Motor Carrier Division, and has been endorsed for reappointment by the executive committee of the American Trucking Associations, Inc.

Can Amlie Qualify?

Just what influenced President Roosevelt to suggest the appointment of Thomas R. Amlie to succeed Balthasar H. Meyer on the Interstate Commerce Commission is difficult to imagine. He could not appoint a Democrat and so suggested an extreme left-winger—a "lame duck" and former congressman who was defeated last year for senatorial nomination in the Wisconsin Progressive primary. The President's action raised a storm of protest and criticism throughout the nation. Both houses of the Wisconsin Legislature immediately passed resolutions asking the President to withdraw the nomination, and calling upon the Senate to refuse confirmation if the President refuses. Roosevelt was clearly irritated when questioned about Amlie at the press conference on January 24. How much longer will the intelligent American public allow the politicians to continue making a football of the railroads?

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Among the Clubs and Associations

CAR DEPARTMENT ASSOCIATION OF ST. LOUIS.—"Wheel Defects, Particularly Those Defects Not Covered by A. A. R. Wheel Gages" will be the topic to be discussed by D. R. Brown of the Southern Wheel Company at the meeting on February 21 at the Hotel Mayfair, St. Louis, Mo. Of especial interest will be the presentation by F. H. Hardin, president of the Association of Manufacturers of Chilled Car Wheels, of the talking motion picture, "The Story of the Chilled Car Wheel." Dinner will precede the meeting at 6:15 p. m.

CENTRAL RAILWAY CLUB OF BUFFALO.—"Freight Loss and Damage" was the feature of the meeting held on February 9 at the Hotel Statler, Buffalo, N. Y.

NEW ENGLAND RAILROAD CLUB.—J. Roberts, chief of motive power and car equipment of the Canadian National, will be the speaker at the meeting to be held on February 14 at the Hotel Touraine, Boston, Mass. Mr. Roberts' topic will be "Railway Equipment Maintenance—Modern Practice vs. Obsolescence Waste." The meeting, "Canadian Night," will start with dinner at 6:30 p. m.

TORONTO RAILWAY CLUB.—The February 27 meeting will be "Maintenance of Way Night." It will be held at 7:45 p. m. at the Royal York Hotel, Toronto, and A. O. Wolff, assistant district engineer, of the Canadian Pacific, and B. Wheelwright, engineer maintenance of way, of the Canadian National, will be the speakers.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—At the meeting at 10 a. m. on March 16 at the Ansley Hotel, Atlanta, Ga., W. L. Rice, superintendent of shops of the Reading Company, Reading, Pa., will present a paper on Practical Shop Operation.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—A continued discussion of the new A. A. R. Rules of Interchange and proposed changes in them for 1940 will feature the February 13 meeting to be held at the LaSalle Hotel, Chicago, at 8 p. m.

NORTHWEST CAR MEN'S ASSOCIATION.—"The Story of the Chilled Car Wheel," the sound moving picture of the Association of Manufacturers of Chilled Car Wheels, was presented by a representative of the Griffin Wheel Company at the meeting of the Northwest Car Men's Association on February 6. Proposed changes in the new A. R. A. rules were also discussed.

RAILWAY CLUB OF GREENVILLE.—G. S. Meek, president and general superintendent of the Pittsburgh & Conneaut Dock Company, will be the speaker at the meeting to be held at 6:30 p. m. on February 16 in Bessemer Hall, B. & L. E. shops, Greenville, Pa. His topic will be "The Story of Unloading Iron Ore at Conneaut, Ohio."

CAR FOREMEN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.—Rule 32 was discussed by F. M. Rezner at the meeting held on the afternoon of February 9 at the Union Pacific shops, Council Bluffs, Iowa.

EASTERN CAR FOREMAN'S ASSOCIATION.—The annual dinner and entertainment of the Eastern Car Foreman's Association was held in the East Ball Room of the Hotel Commodore, Thursday, February 9 at 7 o'clock. The arrangements were made by J. P. Egan, President, who headed a committee of 14 members.

Club Papers

Chilled Wheels in Pictures

New York Railroad Club.—Meeting held January 20 at New York. Presentation of moving picture, "The Story of the Chilled Car Wheel," and remarks by F. H. Hardin, president, Association of Manufacturers of Chilled Car Wheels. ¶ A comprehensive review of the modern process of producing chilled-iron car wheels was presented by Mr. Hardin in the form of a sound moving picture. The picture followed through the various steps in the production process, beginning with the preparation of the scrap wheels for the cupola, through the preparation of the molds, the manufacture of cores and the shaking out and pitting of the castings, to their final finishing on the boring mill. It also presented a number of operations in the well-equipped research laboratory maintained by the association. The story of the narrator which accompanies the film guides the reader in non-technical language through the steps in the process and brings out the extent to which scientifically accurate controls are replacing rule-of-thumb methods in the industry. ¶ In his talk before the picture was shown Mr. Hardin called attention to a number of points in the film which had raised questions where it had been previously shown. The temperature of the melted iron, he said, was kept as nearly as possible up to 2,700 deg. F. and poured at a temperature of around 2,450 deg. F. He also referred to the use of instruments for the control of cupola operation which are a development of the association's research organization. These were first developed in the form of a recording carbon-dioxide meter and a separate recording air-flow meter, the control to maintain uniform carbon dioxide being manual. Later the two recording instruments, he said, were coupled up and are now operating as an automatic control, by means of which constant carbon dioxide is maintained by automatically varying the air volume. ¶ In referring to the breaking of wheels to check the depth of chill by visual inspection, Mr. Hardin pointed out that it is now possible to combine the physical, chemical and metallurgical characteristics and develop a scientific method of determining the depth and wear value of the chill without the necessity of visual inspection. ¶ One of the most important improvements in the production of chilled-iron wheels is the new low-heat-capacity annealing pits which are replacing the old type sand pits. These unit pits stand in the open surrounded by air and each consists of a steel shell lined with an efficient insulating material. The wheels are pitted at a high temperature; the hub and tread diameters are equalized well above the critical point, and then are cooled at a rate of 8 to 10 deg. per hour. No firing is necessary, neither is a transfer of wheels from one pit to another at lower temperature to effect cooling. No matter how long the wheels stay in the pit, they will not be over-annealed.

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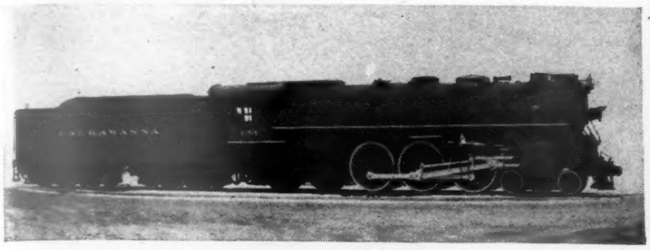
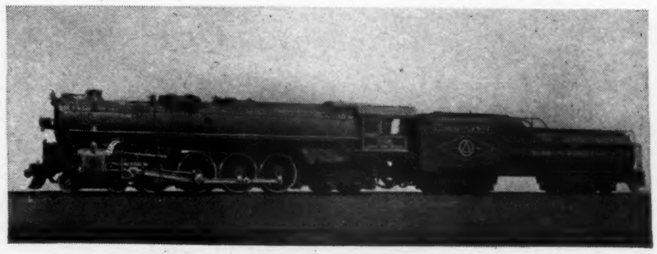
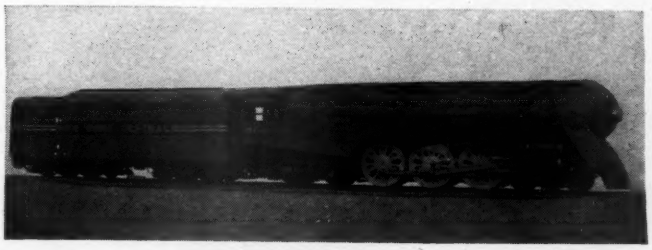


Delaware, Lackawanna & Western R. R.



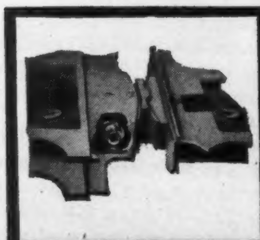
Richmond, Fredericksburg & Potomac R. R.



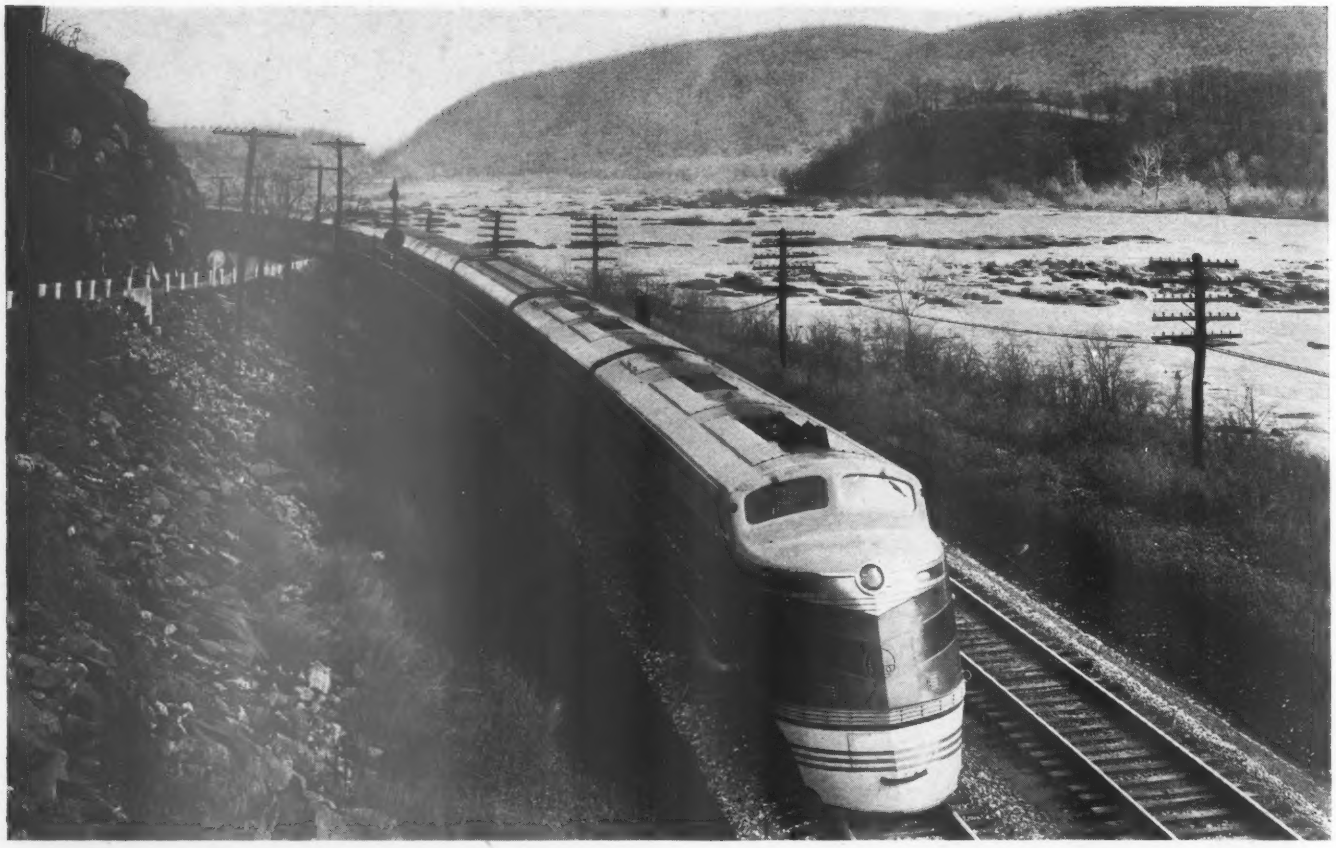
New York Central System

Lehigh Valley R. R.

Atlantic Coast Line R. R.



Franklin Type E-2 Radial Buffer dampens oscillation between engine and tender and makes for easier riding.



The newly streamlined Capitol Limited of the Baltimore & Ohio in the picturesque Potomac River Valley near Sandy Hook, Md., en route to Chicago from Baltimore, Md.

NEWS

Bureau of Safety Annual Report

During the year under review in the annual report of W. J. Patterson, director of the Bureau of Safety, Interstate Commerce Commission, Washington, D. C., a total of 1,213,081 cars and locomotives was inspected; 29,286 or 2.41 per cent were found defective as compared with the 2.31 per cent defective out of the 1,203,752 inspected in 1936-37. While last year's showing was thus less favorable than that of the previous year it was better than the record for 1935-36 when 2.44 per cent of the rolling-stock units inspected were found defective.

During the fiscal year there were 1,469 collisions and 3,823 derailments reported to the I. C. C.; in these, 195 persons were killed and 1,115 injured, as compared with 210 killed and 1,277 injured in the 1,940 collisions and 5,050 derailments reported in the previous fiscal year ended June 30, 1937.

Air-brake tests on 2,753 trains prepared for departure from terminals showed the air brakes on 99.9 per cent of the cars operative. It was necessary to set out cars or repair the brakes on an average of three cars for practically every five trains tested by the inspectors. Similar tests on 829 trains arriving at terminals showed that brakes were operative on 98.12 per cent of the cars—the cars with inoperative brakes averaging slightly less than one per train.

The report notes that the work of equipping cars with AB brakes is behind schedule. Attention is directed to the fact that during 3½ years, or 35 per cent of the 10-year period, only 11.3 per cent of the freight cars in interchange service have been equipped with the present standard air-brake apparatus. The reports show that 13 railroads and 19 private car lines have 30 per cent of their cars so equipped; but "107 railroads and 122 private car lines have not as yet reported any cars so equipped."

"Material improvement has been noted in the efficiency of hand-brake equipment on passenger cars, as a result of the adoption of rules . . . governing inspection and maintenance" of such equipment. Also, "co-operative efforts" with the A. A. R. have continued "for improving the conditions of couplers, draft gears and their attachments and supports." During the 15 months prior to June 30, 1938, there was no accident investigated by the Bureau in which free slack in draft gears or defective supports was found to be the cause or a contributing factor. "However," the report adds, "the large number of break-in-twos of trains, due to slipovers of knuckles, indicates that additional improvement is essential." The Bureau has called the A. A. R.'s attention to the "urgent need" for establishing "a standard and a maximum permissible vertical movement of the coupler head from the position at which its standard height is determined."

Discussing the arch-bar truck the report cites a December, 1937, accident wherein "the hazard of their use was again forcibly demonstrated." "Accumulated experience," the report adds, "plainly indicates the need of extreme precautions with these obsolete trucks during their remaining period of service."

As in other recent years the report includes a brief discussion of braking methods and apparatus for high-speed streamlined trains. After noting that the Bureau has joined with the railroads and brake manufacturers in several tests, the report adds: "Brake performance on high-speed trains in service has not developed results on a parity with results obtained on conventional equipment at lesser speeds. Means of preventing destructive temperatures of both the brake shoes and the wheels resulting from the increase of braking force necessary to control trains oper-

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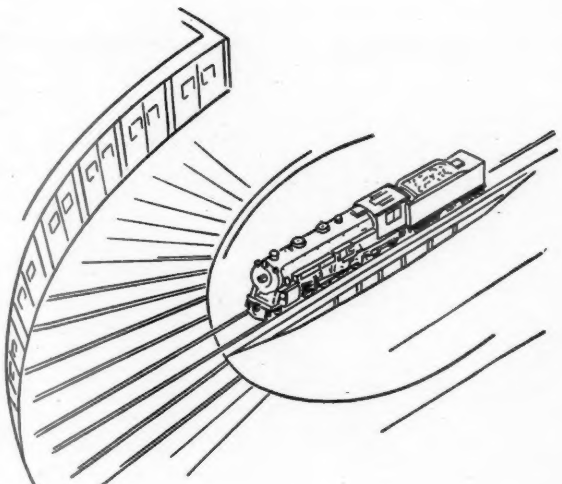
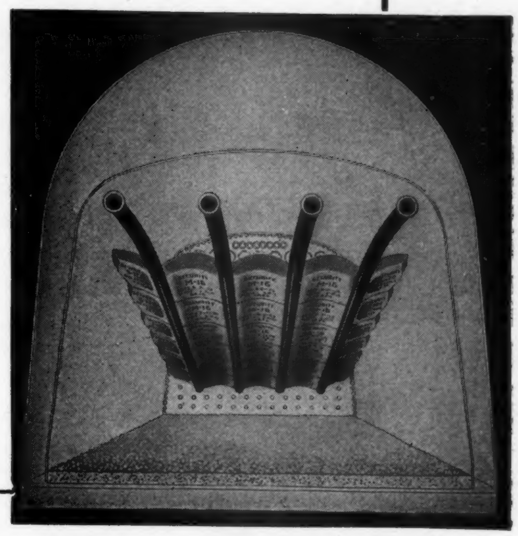
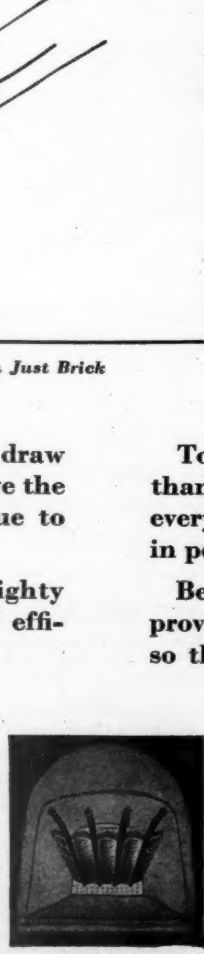




There's More to **SECURITY ARCHES** *Than Just Brick*



ated at extremely high speeds so as to maintain a degree of efficiency and safety equivalent to that provided at the lower speeds which generally prevail have not been satisfactorily developed. Experiments employing means other than applying the braking force to the treads of the wheels and thereby relieving the wheels of the dangers incident to excessive heating, are also being carried on and the results are being duly observed and considered by the Bureau. Experiments and tests in both service and emergency braking on high speed trains will be continued in order to determine the greatest degree of efficiency which it is practicable to attain."

Contemplated Expenditures for New Equipment and Betterments

New York, New Haven & Hartford.—The federal district court at New Haven, Conn., has authorized the trustees of this road to make expenditures totaling $1,514,158 for replacements and new equipment.

Missouri Pacific.—The federal district court at St. Louis has authorized the trustee of the Missouri Pacific and subsidiaries to spend $8,560,864 for betterments and improvements to roadway, shop buildings, motive power and car equipment, etc. Of the total amount $4,988,211 is chargeable to capital account.

In another petition not yet approved, the trustee suggested that an additional $4,623,000 be spent by the Missouri Pacific for two 900-hp. Diesel-electric locomotives for use on its Union-Lincoln lines, costing $198,000; three 900-hp. and two 600-hp. Diesel-electric locomotives for use in the St. Louis terminal, costing $381,000; two streamlined trains, $360,000 for the locomotives and $984,000 for the cars; and 1,000 50-ton flat bottom gondola cars, costing $2,700,000; and 200 50-ton box cars and 50 50-ton coal cars, costing $860,000, for the Missouri & Illinois.

St. Louis-San Francisco.—A petition to spend $1,311,700 for additions and improvements on the Frisco, has been approved by the district court. Of this amount, $998,103 will be used for roadway improvements and $313,617 for mechanical improvements. Five locomotives will be rebuilt in the company's shops at Springfield, Mo.

Chicago, Rock Island & Pacific.—The budget of the Rock Island for 1939 provides for expenditures aggregating $32,412,000 for improvements of roadway and equipment and maintenance, exclusive of expenditures for new equipment, a budget for which has not yet been completed, improvements to engine terminals, electrification of shop machinery and tools, and the modernization of fueling facilities and water stations are also provided for. Besides these expenditures, there is a carry-over of $1,500,000 from the 1938 improvement budget.

The equipment improvement program included in the $32,412,000 budget provides for the application of roller bearings and new engine trucks on locomotives, and for new locomotive tenders and tanks of increased capacity. It also provides for the application of stokers to locomotives not already equipped. It further provides for modernization and improvements to passenger-train cars, and the re-building of some freight equipment.

The Rock Island is also considering the purchase of streamline trains for use between Chicago and Denver, Colo.

F. K. Vial Awarded First Prize in Instrumentation Contest

F. K. VIAL, vice-president in charge of research of the Association of Manufacturers of Chilled Car Wheels, was awarded the first prize of $200 in the first Instrumentation Contest sponsored by the Industrial Instrument Section of the Scientific Apparatus Makers of America, Chicago. The contest, conducted by Richard Rimbach, publisher of Instruments, was open to engineers or operating men not employed by an instrument manufacturer, and essays were to describe "an unusual application of a standard instrument or control device, telling briefly what conditions or need impelled the application." "Instrument or control device" was defined as "any device used for measurement and control, or any accessory used with a device for measurement and control."

Mr. Vial's paper was on the Automatic CO_2 Compensator for Cupola Control, which is a pioneer application of automatic combustion control to the cupola.

Equipment Depreciation Rates

EQUIPMENT depreciation rates for fourteen railroads, including the Union Pacific, the Minneapolis, St. Paul & Sault Ste. Marie, and the Akron, Canton & Youngstown, are prescribed by the Interstate Commerce Commission, in two other series of sub-orders and modifications of previous sub-orders in No. 15,100, Depreciation Charges of Steam Railroad Companies. The composite percentages, which are not prescribed rates, range from 3.37 for the Cheswick & Harmar and the Sumpter Valley, and 3.42 for the Soo Line to 22.89 for the Bowdon. The latter is also the Bowdon's prescribed rate for passenger-train cars, since the present sub-order, a modification of a previous one, covers only that class of equipment. The A. C. Y.'s composite figure was 4.03.

The A. C. & Y.'s prescribed rates are as follows: Steam locomotives, 3.55; freight train cars, 5.69; passenger train cars, 3.83; work equipment, 3.61; and miscellaneous equipment, 17.96.

The Union Pacific's composite percentage of 3.96 is derived from prescribed rates as follows: Steam locomotives, 3.9 per cent; other locomotives, 7.19 per cent; freight-train cars, 3.81 per cent; passenger-train cars, 3.94 per cent; floating equipment, 4.9 per cent; work equipment, 5.09 per cent; miscellaneous equipment, 15.39 per cent. These rates cover also equipment leased from the Los Angeles & Salt Lake; the Oregon Short Line; the Oregon-Washington Railroad & Navigation; and the St. Joseph & Grand Island.

The Soo Line's prescribed rates are as

(*Continued on next left-hand page*)

New Equipment Orders and Inquiries Announced Since the Closing of the January Issue

LOCOMOTIVE ORDERS

Company	No. of Locos.	Type of Loco.	Builder
Erie	2	600-hp. Diesel-electric	Electro-Motive Corporation
Ft. Worth Belt	1	600-hp. Diesel-electric	Electro-Motive Corporation
C. & N. W.	2[1]	....	Electro-Motive Corporation

LOCOMOTIVE INQUIRIES

Company	No. of Locos.	Type of Loco.	Builder
Southern Pacific	28	4-8-8-2 type	....
	12	2-8-8-4 type	....

FREIGHT-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
U. S. Navy Department	3	60-ton flat	Haffner-Thrawl Car Co.

FREIGHT-CAR INQUIRIES

Road	No. of Cars	Type of Car	Builder
John Morrell & Company	100	Refrigerator	....
Great Northern	25	16,000-gal. tank	....
Mexican Government Railways	10	50-ton flat	....
	10	50-ton gondola	....
National Tube Company	6	70-ton hopper	....
	1	70-ton gondola	....
Pittsburgh & West Virginia	300	55-ton hopper	....
	100	50-ton steel box	....
Union Pacific	1,000-2,000	50-ton box	....
	300	50-ton flat	....

PASSENGER-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
Chicago & North Western	See footnote.[1]		
Pennsylvania	5[2]	Dining	Edward G. Budd
	12[2]	Coaches	Edward G. Budd
	5[2]	Dining	Pullman-Std.
	5[2]	Dining	American Car & Fdry.

PASSENGER-CAR INQUIRIES

Road	No. of Cars	Type of Car	Builder
Union Pacific	10-15	Chair	....

[1]The Chicago & North Western has ordered two light-weight streamline Diesel-electric passenger trains for its "400," operating between Chicago and the Twin Cities, authority for the purchase of this equipment being granted by the United States District Court at Chicago on January 24. The two Diesel-electric locomotives are being built by the Electro-Motive Corporation at a cost of $720,000. Each of the two units will contain four 1,000-hp. engines. They are designed for operation without turn around thereby make two trips daily. The 20 cars costing $1,600,000, have been ordered from the Pullman-Standard Car Manufacturing Company. The consists of each train include a taproom-lounge car, four coaches, one dining car, three parlor cars and one observation-club car. The capacity of each train will be 409 seats excluding accommodations in smoking rooms, but including 56 seats in coaches, 27 in each parlor car, 56 in the diner, 12 in the parlor-lounge-observation car and 36 in the taproom lounge.

[2]These diners and coaches are to augment the equipment of "Blue Ribbon" east and west through trains and are to be fully streamlined. The Budd-built equipment will be fabricated of stainless steel. The Pullman-Standard cars will be of aluminum alloy, and five by the American Car & Foundry Co., of high tensile steel. The cost of the new equipment will be about $2,100,000. In addition, there are under construction at the Budd plant 2 new streamlined steel coaches which will be ready for delivery in the next few weeks.

follows: Steam locomotives, 3.05 per cent; freight-train cars, 3.08 per cent; rebuilt freight cars, 5.27 per cent; second-hand freight cars, 5.71 per cent; passenger-train cars, 2.8 per cent; work equipment, 3.58 per cent; miscellaneous equipment, 9.8 per cent.

Senate Gets Reed Nomination for Retirement Board

PRESIDENT ROOSEVELT has sent to the Senate the name of M. Roland Reed for confirmation as a member of the Railroad Retirement Board for the five-year term beginning August 29, 1938. Since that date Mr. Reed, who succeeded James A. Dailey, has been serving as the Board's "railroad" member. A former superintendent of motive power on the Pennsylvania's Eastern Pennsylvania division, he was nominated by the Association of American Railroads, while 137 of the American Short Line Railroad Association's 310 members favored the reappointment of Mr. Dailey. The President followed the A. A. R. recommendation.

Inventor of Rotary Snow Plow Dies at 88

JOHN S. LESLIE, designer of the first successful rotary snow plow, the main features of which are embodied in modern apparatus of this type, died on January 10 at his home in Paterson, N. J., at the age of 88, after a long illness. While J. W. Elliott originally devised the rotary principle in snow-fighting equipment in 1869, it was Mr. Leslie who designed the first practicable machine embodying rotary motion and the cutting wheel of Orange Jull, which was tested by the Canadian Pacific at Parkdale, Ont., in 1883. This design was improved by changes in the knives and the addition of rail ice-cutters in a plow built by the Cooke Locomotive Works and put in service by the Chicago & North Western in 1885. In 1886 this plow was further refined by the substitution of a single fan wheel for opposite revolving wheels and was tried out on the Union Pacific in a test conducted personally by Mr. Leslie. Rotary plows have since grown larger and heavier, but the essentials remain as designed by J. S. Leslie.

Mr. Leslie, in 1905, founded the Leslie Company, manufacturers of valves, and remained president until his retirement in 1926.

Supply Trade Notes

REVERE COPPER & BRASS, INC., has completed a $3,250,000 brass and copper mill at Rome, N. Y. The mill has a monthly capacity of 2,000,000 lb. of brass strip up to 20 in. in width.

◆

LOUIS J. GALBREATH, head of the Product Development Department of Revere Copper and Brass, Inc., has been appointed technical adviser for the New York district sales division, with headquarters at 75 E. 45th street, New York City.

◆

J. B. PEDDLE, St. Louis, Mo., has been placed in charge of sales of the railway division of the Morton Manufacturing Company, Chicago, for the southwestern district.

◆

G. J. WEBER has been appointed executive assistant to president, Association of Manufacturers of Chilled Car Wheels, Chicago, also continuing in his present position as secretary of the association.

◆

THE PACIFIC CAR & FOUNDRY CO., has moved its Seattle, Wash., office to 220 West Hudson street.

◆

THE OHIO BRASS COMPANY has moved its Chicago office from 20 North Wacker Drive to 231 South LaSalle street.

◆

THE HYDRO TRANSMISSION CORPORATION has been organized, with headquarters at Hamilton, Ohio, and officers as follows: Heinrich Schneider, president; J. E. Peterson, vice-president and treasurer; Adolph Schneider, vice-president; John B. Hollister, secretary. The company will handle engineering sales of an hydraulic transmission unit for Diesel switching locomotives and Diesel rail cars. The device will be manufactured under contract by the General Machinery Corporation, Hamilton, Ohio.

WILLIAM H. WINTERROWD, vice-president of the Franklin Railway Supply Company, has been elected vice-president in charge of operations of the Baldwin Locomotive Works, with headquarters at Eddystone, Pa., effective about February 15. Mr. Winterrowd graduated from Purdue University as a mechanical engineer in 1907. During college vacations he worked successively as a locomotive wiper, blacksmith helper and car repair helper. In 1907, upon graduation from college, he started as a special apprentice with the Lake Shore & Michigan Southern (now the Buffalo-Chicago section of the New York Central), where he served in the repair shops and enginehouses in various capacities until 1912 when he became assistant engineer in the mechanical department. Later in the same year, Mr. Winterrowd went to the Canadian Pacific as mechanical engineer. In 1915 he became assistant chief mechanical engineer and in 1918 chief mechanical officer of that road. In 1923 he joined the organization of the Lima Locomotive Works, Inc., as assistant to the president and, in 1927, he became vice-president of that company. Since 1934 he has been vice-president of the Franklin Railway Supply Company, Inc., an associated company of the Lima Locomotive Works, Inc. In 1936 Mr. Winterrowd received the degree of doctor of engineering from Purdue University. He is a director of the Purdue Research Foundation, and a member of the Mechanical Division, Association of American Railroads. He is also a member of a number of engineering societies.

W. H. Winterrowd

◆

THE BRIDGEPORT SAFETY EMERY WHEEL COMPANY has authorized C. D. Hicks & Company to offer its equipment to the railroads in the southwestern territory.

◆

NEIL C. HURLEY, JR., secretary of the Independent Pneumatic Tool Company, Chicago, has been elected vice-president. Mr. Hurley joined the company in 1932, upon graduation from the University of Notre Dame, and has been active in the direction of sales for the company's electric tool division.

◆

JOHN E. LONG has been appointed western sales manager of the Franklin Railway Supply Company, Inc., with headquarters in the McCormick building, Chicago. Mr. Long was graduated from Purdue University in 1923 with the degree of B. S. in mechanical engineering. Prior to his graduation he was employed in various capacities by the Pennsylvania, the Baltimore & Ohio, and the Atchison, Topeka & Santa Fe. In 1923 he entered the service of the Lima Locomotive Works, Incorporated, where he remained eleven years, during which time he was in the calculating, service, engineering and sales departments and had extensive experience in special design work and in locomotive testing. He also engaged in the study of operating conditions on various roads. In 1934, Mr. Long joined the Franklin Railway Supply Company, Inc., with headquarters at Chicago, where he has since been employed.

James H. Critchett, who has been in charge of research work, and Francis B. Morgan, who has been works manager of the Electro Metallurgical Company, a unit of Union Carbide and Carbon Corporation, New York, have been elected vice-presidents of the Electro Metallurgical Company.

◆

The Inland Steel Company, on January 3, completed a new blast furnace at its Indiana Harbor, Ind. plant. The furnace has a capacity of 1000 tons of pig iron, which will increase the company's productive capacity to more than 4,000 tons daily.

◆

The DeVilbiss Company, Toledo, Ohio, has announced training-school classes of one week each beginning March 13, April 17, May 15 and June 5. The school is open to industrial painters, master painters, automobile refinishers and others interested in learning the technique of spray-painting and the use and care of spray-painting equipment.

◆

Thomas Drever has been elected vice-president and treasurer of the American Steel Foundries, Chicago, succeeding George E. Scott, deceased. Mr. Drever was born in Edinburgh, Scotland, on May 2, 1882, and began his business career in that city in 1905 as a chartered accountant. In the same year he came to the United States and became an accountant in New York. From 1907 to 1910 he engaged in the same work at Boston, Mass. In the latter year he was appointed comptroller of the American Steel Foundries at Chicago, which position he held until 1924

Thomas Drever

when he was granted a leave of absence to become president of the Wahl Company. In 1929 Mr. Drever returned to the American Steel Foundries as secretary and treasurer. Later in that year he was a made a director and member of the executive committee. In 1932 he was elected vice-president and treasurer. Since 1929 he has been chairman of the board of the Wahl Company; vice-president and a director of the Griffin Wheel Company, Chicago, and a director and a member of the executive committee of the General Steel Castings Corporation, Eddystone, Pa.

The Universal Railway Devices Company, Chicago, has been incorporated in Delaware to take over and succeed to the business of the Universal Draft Gear Attachment Company, an Illinois corporation, with no change in the officers or personnel.

◆

James P. Raugh has been appointed general sales manager of the General Refractories Company, Philadelphia, Pa.

◆

Neil C. Hurley, Jr., has been elected a vice-president of the Independent Pneumatic Tool Company, Chicago.

◆

The United States Rubber Company, Mechanical Goods Division, Baltimore branch, which has heretofore functioned under supervision of the Philadelphia branch, will, in future, operate as an independent branch, under R. F. Jackson, as manager of mechanical sales. Frank M. Urban, assistant to W. T. Keenan, manager mechanical sales, Chicago branch, has been appointed assistant manager, mechanical sales, Chicago branch.

◆

The American Rolling Mill Company, Middletown, Ohio, has reorganized the home office of its Sheet and Strip Sales division. F. A. Tobitt, manager of enameling sheet sales, has been appointed manager of eastern sales, J. A. Ingwersen, manager of hot and cold rolled sales, has been appointed manager of midwestern sales, and G. W. Breiel, manager of galvanized and long terne sales, has been appointed manager of the southwestern sales.

Obituary

William P. Bradbury, vice-president and general sales manager of the Consolidated Ashcroft Hancock Division of Manning, Maxwell & Moore, Inc., Bridgeport, Conn., died of pneumonia on Saturday, January 14.

◆

Forrest M. Titus, formerly sales engineer of the American Locomotive Company at Peiping, China, died on January 15 at Paterson, N. J. Mr. Titus was born on March 28, 1868, at Conneaut, Ohio. He was educated in the public high school of that city, and from 1890 until 1896 was, successively, an apprentice and a journeyman machinist in the employ of the New York, Chicago & St. Louis at Conneaut. He was shop foreman at Conneaut for the next five years, in 1901 becoming journeyman machinist in the service of the Union Pacific at Cheyenne, Wyoming. In 1902 he became a machinist in the employ of the American Locomotive Company at Pittsburgh, Pa., and some time later returned to the Nickel Plate at Conneaut. From 1904 until 1907 he was on the staff of the superintendent of motive power of the Union Pacific, in charge of shop efficiency work. He became general inspector of the American Locomotive Company, in charge of locomotive inspection work at their several plants, in 1907, and in 1910 was appointed foreign erecting engineer in charge of the installation of locomotives in Brazil. In 1912 he became assistant general superintendent of motive power of the Brazil Railways, in charge of the department of shops and motive power. In 1913 he was appointed general superintendent of motive power of the Brazil Railways, in full charge of the motive power department, with headquarters at Sao Paulo. The department was abolished at the outbreak of the World War, and in 1914 Mr. Titus went to Ichang, China, as superintendent of motive power, I-Kwei Section, Szechuen-Hankow Railway, act-

F. M. Titus

ing in an advisory capacity on the layout of shops, the selection of shop machinery, and on motive power and rolling stock. In the autumn of 1915 he became foreign erecting engineer of the American Locomotive Company, in charge of the installation of locomotives for the Trans-Siberian Railway at Harbin. From 1916 until 1933 he was sales engineer of the American Locomotive Company at Peiping, his territory including China, Japan, Korea and Formosa. He left the American Locomotive Company in 1934, and from 1935 until the outbreak of Japanese-Chinese hostilities in 1937 was mechanical engineer of the Nanking-Shanghai Railroad and advisor to the Chinese Ministry of Railroads.

◆

Charles A. Seley, consulting engineer of the Locomotive Firebox Company, Chicago, died in that city on January 19, of general debility. Mr. Seley was born at Wapella, Ill., on December 26, 1856, and entered railway service in 1879 as a draftsman for the St. Paul, Minneapolis & Manitoba, now part of the Great Northern. From 1881 to 1886, he engaged in other work of a mechanical engineering nature and in the latter year became chief draftsman for the St. Paul & Duluth, now part of the Northern Pacific. From 1888 to 1892, he was employed by the Great Northern. In the latter year he entered the railway supply business and after three years returned to railway service as chief draftsman for the Chicago Great Western. In April, 1899, he became mechanical engineer of the Norfolk & Western and in 1902 mechanical engineer of the Chicago, Rock

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Modern Equipment Needed To Reduce Expenses

The experience of recent years has indicated that, with increasing competition of other forms of transportation, the prospects of adding greatly to the gross revenues of the railroads are not particularly bright, surrounded with some uncertainty even with an improvement in general business conditions. For this reason, it is of great importance that every opportunity be grasped to effect permanent and substantial reductions in the cost of operation.

As far as the mechanical departments are concerned, they are directly responsible for the largest single item of operating expense—steam locomotive repairs—and, indirectly have considerable control over the fuel expense. These two items of operating expense, plus the expenditures for freight and passenger car repairs, amounted in 1937 to over 550 million dollars.

There are, therefore, two avenues open over which the mechanical officers have considerable control, the cost of locomotive operation and the cost of car and locomotive maintenance. With 67 per cent of the steam locomotives in this country over 20 years of age, it is well recognized that. as rapidly as funds can be found to finance their purchase, the introduction of modern motive power will contribute immeasurably to substantial reductions in the expense for fuel and maintenance.

In these days of small equipment replacement programs, the shop and engine terminal supervisor is working against odds in his battle to reduce maintenance costs for, if for no other reason, the increasing age of motive power brings about increases in the unit costs of repairs while, at the same time, a similar condition with respect to machine tools and shop equipment is making it more and more difficult to turn out repair work as economically and efficiently as it could and should be done with modern equipment. It is a case where the cost of repairs is automatically increasing because of a condition that can only be remedied by the modernization of equipment and repair facilities.

Whatever may be the ultimate outcome of the wage controversy, it does not alter the fact that the railways must save money.

It would seem, therefore, the railroad managements have arrived at a point where they must make a decision as to the future course to be followed in order to assure that their properties may remain solvent. Fortunately, with respect to both locomotive equipment and the facilities with which they are maintained, the records of performance of such equipment as has been installed in the last five or six years, proves conclusively that substantial reductions in operating and maintenance costs can be made.

Railway Mechanical Engineer
NOVEMBER, 1938

RECORDS AND
RMANCE PROVE

at EMC Diesel Switchers
ce Operating Expenses 50%

RECORDS of over ONE MILLION service hours show that EMC Diesel operation has slashed fuel costs 75 per cent—maintenance costs 50 per cent and water costs eliminated entirely. Availability is averaging 94 per cent with records as high as 98 per cent. EMC switchers are saving more than $1,000.00 per month net over and above carrying and amortization charges. Potential economies also can be appraised from the fact that on one railroad 37 EMC Diesels have replaced 80 steam switchers.

Diesel Operation—The Greatest Advance in Modern Railroading.

ELECTRO-MOTIVE CORPORATION

SUBSIDIARY OF GENERAL MOTORS LA GRANGE, ILLINOIS, U. S. A.

GM DIESEL POWER

Island & Pacific at Chicago. On May 1, 1913, he again left railway service and became president of the American Flexible Staybolt Company, which company he helped to organize and with which he continued until its dissolution in 1921. In 1923, he became consulting engineer for the Locomotive Firebox Company. During his railway service he was a member of the executive committee of the Master

Charles A. Seley

Mechanics' Association for six years and of the Master Car Builders' Association for two years. He was a member of the subcommittee of the Association of American Railroads on the relation of railway operations to legislation in the matter of safety appliances, and wrote existing specifications for steel postal cars. He was president of the Western Railway Club during 1907-08.

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Albert E. Brown, general manager of railroad sales of the Truscon Steel Company, with headquarters at New York, died in Chicago on January 5 of a lingering illness.

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Fred O. Smith, vice-president of the Vulcan Iron Works, builder of locomotives, died suddenly at his home in Wilkes-Barre, Pa., on January 21. Mr. Smith was 62 years of age at the time of his death.

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Frank Norton Hoffstot, founder and former president of the Pressed Steel Car Company, Inc., Pittsburgh, Pa., who died on December 25, as reported in the January issue, was born on May 31, 1861, in Pittsburgh, where he became active in banking, real estate and the iron and steel industry. Mr. Hoffstot became interested in financing companies and, in 1898, Charles T. Schoen, president of the Schoen Pressed Steel Company, received from Mr. Hoffstot financial backing for his idea of building cars of steel. The Schoen Pressed Steel Company and the Fox Pressed Steel Company were consolidated to form the Pressed Steel Car Company, which was the first company to manufacture pressed steel cars. It was organized in 1899 with Mr. Schoen as president. In 1901 Mr. Hoffstot became president of the company, remaining in that capacity for 33 years. When the Pressed Steel Car Company went into receivership, Mr. Hoffstot became one of the three receivers, serving

Frank Norton Hoffstot

until the summer of 1934, when he retired and sold all of his interests in the company. Mr. Hoffstot was a metallurgist in addition to his other business interests.

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George E. Scott, president of the American Steel Foundries, Chicago, died on January 11, of a heart attack in Rochester, Minn., where he had gone for a throat operation.

Personal Mention

General

A. G. Mueller, air brake instructor of the Chicago, Rock Island & Pacific, at Chicago, has been promoted to general mechanical inspector, with headquarters in the same city.

J. W. Bailey, superintendent of motive-power shops of the Canadian National at Montreal, Que., has been appointed superintendent of motive-power shops at Stratford, Ont. Mr. Bailey was born February 15, 1885, in Liskeard Borough, Cornwall, England. He entered the service of the Canadian National at Fort Erie, Ont., on June 23, 1906, as a machinist in the local shops. On November 1, 1917, he was transferred to Lindsay as locomotive foreman. He became general foreman at Deering, Me., on November 1, 1922, and on October 10, 1930, was transferred to Montreal as night foreman at Longue Pointe. Four years later he went to Allandale, Ont., as locomotive foreman, and on May 1, 1935, returned to Montreal as general foreman. On March 1, 1937, he was appointed superintendent of the motive power shop at Montreal.

J. W. Bailey

O. K. Woods, locomotive engineer on the Colorado division of the Union Pacific, has been appointed fuel engineer of the Eastern district, with headquarters at Omaha, Neb.

H. G. Baker, road foreman of engines on the Idaho division of the Union Pacific, has been promoted to fuel engineer of the South-Central and Northwestern districts, with headquarters at Pocatello, Idaho.

C. P. Blair, assistant road foreman of engines of the Norfolk Division of the Norfolk & Western, has been appointed assistant trainmaster of the Shenandoah division.

W. C. Sealy, superintendent of motive-power shops of the Canadian National at Stratford, Ont., has been appointed superintendent of motive-power and car shops, with headquarters at Montreal, Que. The position of superintendent of motive-power shops at Montreal has been abolished. Mr. Sealy began service with the Canadian National as a messenger in the shops at Stratford in May, 1903, and one year later began his apprenticeship as a mechanic which was terminated in June, 1908. In November, 1909, he was appointed erecting shop foreman and in 1910 was transferred to Toronto, Ont., as general foreman. He was subsequently assistant master mechanic and master mechanic, the latter appointment being in November, 1915. During 1917 Mr. Sealy's services were loaned to the General Car and Machinery Company and he was employed at Montmagny, Que-

bec, instructing in the installation of a shell-manufacturing plant. He returned to Stratford in September, 1917, as foreman during a period when that shop was also engaged in the manufacture of shell for the British Army. In 1921 Mr. Sealy became general foreman at Stratford and in October, 1928, was appointed acting superintendent of the motive-power shop there, being confirmed as superintendent of the motive-power shop in January, 1929.

W. C. Sealy

Master Mechanics and Road Foremen

J. L. Cato, master mechanic on the Southern Pacific Lines in Texas and Louisiana, with headquarters at El Paso, Tex., retired on January 1, and the position of master mechanic at El Paso has been abolished.

Arthur H. Fiedler, road foreman of engines on the Northern Pacific, with headquarters at Livingston, Mont., has been promoted to master mechanic of the Fargo division, with headquarters at Jamestown, N. D.

L. J. Gallagher, master mechanic of the Fargo division of the Northern Pacific has been transferred to Parkwater, Wash.

Car Department

G. McLennan, superintendent of car shops of the Canadian National at Montreal, Que., has retired. The position of superintendent of car shops at Montreal has been abolished. Mr. McLennan was born on November 22, 1879, and began railway service as coach carpenter in the car department of the Canadian National at Montreal in 1907. After many years of service at Montreal he also served at Toronto and Ottawa, being transferred back to Montreal in 1928 as superintendent of car shops.

W. G. Palmer, freight-car-shop foreman of the Canadian National at Montreal, Que., has been appointed general foreman of the car shops at Montreal, Que.

George Steuber, shop superintendent of Despatch Shops, Inc., has been promoted to assistant to the vice-president and general manager and shop superintendent.

Shop and Enginehouse

Marshall Hogan, machinist on the Pere Marquette at St. Thomas, Ont., has been promoted to the position of enginehouse foreman, with headquarters at Chatham, Ont.

Percy W. McNevin has been appointed acting general foreman on the Canadian National at Charlottetown, Prince Edward Island, succeeding J. A. Miller, retired.

Winsby Walker has been appointed general foreman of the motive-power shops of the Canadian National at Montreal, Que.

Purchasing and Stores

K. L. Brenner, assistant purchasing agent on the Wabash, at St. Louis, Mo., has been appointed acting purchasing agent at that point, succeeding to the duties of T. J. Frier, who has been granted a leave of absence on account of ill health.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

Threading Equipment.—Landis Machine Company, Inc., Waynesboro, Pa. Booklet illustrating and briefly describing Landis threading machines, die heads, taps, etc.

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Washers.—Wrought Washer Mfg. Co., 2100 S. Bay street, Milwaukee, Wis. Stock list No. 55-B. Lists washer specifications in various materials, including steel, brass, copper, aluminum, fibre, etc.

◆

Safety-Pull.—Coffing Hoist Co., Danville, Ill., 12-page catalog No. S4. Safety-Pull ratchet lever hoists and load binders.

◆

Drill Pointer.—Oliver Instrument Co., Adrian, Mich. Seven-page booklet. General description and specifications for the new Oliver of Adrian drill pointer.

◆

Thermit Welding; Murex Electrodes.—Metal & Thermit Corporation, 120 Broadway, New York. The Thermit welding process and its applications are described and illustrated in a 34-page booklet; the physical properties and chemical analysis of the weld deposited by each of 20 odd electrodes in the Murex line, in a new edition of the pocket-size pamphlet on Murex welding rods.

Copper and Copper Alloys.—Revere Copper and Brass, Incorporated, 230 Park avenue, New York. Four-page reprint containing a brief summary of the important properties and typical industrial applications of thirty representative coppers and copper-base alloys discussed in a paper by M. G. Steele, technical advisor of the Baltimore division of the company before the Baltimore Purchasing Agents Association, November, 1937. Important properties of the coppers and copper-base alloys and forms in which each is commercially supplied, as well as uses and methods of fabrication, are charted in tabular form.

◆

Pneumatic Riveters.—Hannifin Manufacturing Company, Chicago. Bulletin No. 43; 12-pages. Describes a recent development in Allen-type portable and stationary pneumatic riveters. Furnishes comprehensive information concerning the construction, capacities and operating advantages of pneumatic riveting machines and gives information regarding Hannifin hydraulic riveters, also pneumatic and hydraulic equipment for use in various production operations.

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Molybdenum In Steel.—Climax Molybdenum Company, 500 Fifth avenue, New York. A 12-section, loose-leaf compilation of useful data on all types of molybdenum steels, both wrought and cast, steel for elevated-temperature-service, corrosion-resisting steels, and cast steels. Comprehensively indexed.

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Do-All Machine.—Continental Machine Specialties, Inc., Minneapolis, Minn. 1301-7 Washington Avenue S. Illustrated folder giving information on filing and sawing speeds for more than 48 materials and other data on selection and use of cutting tools employed for contour machining.

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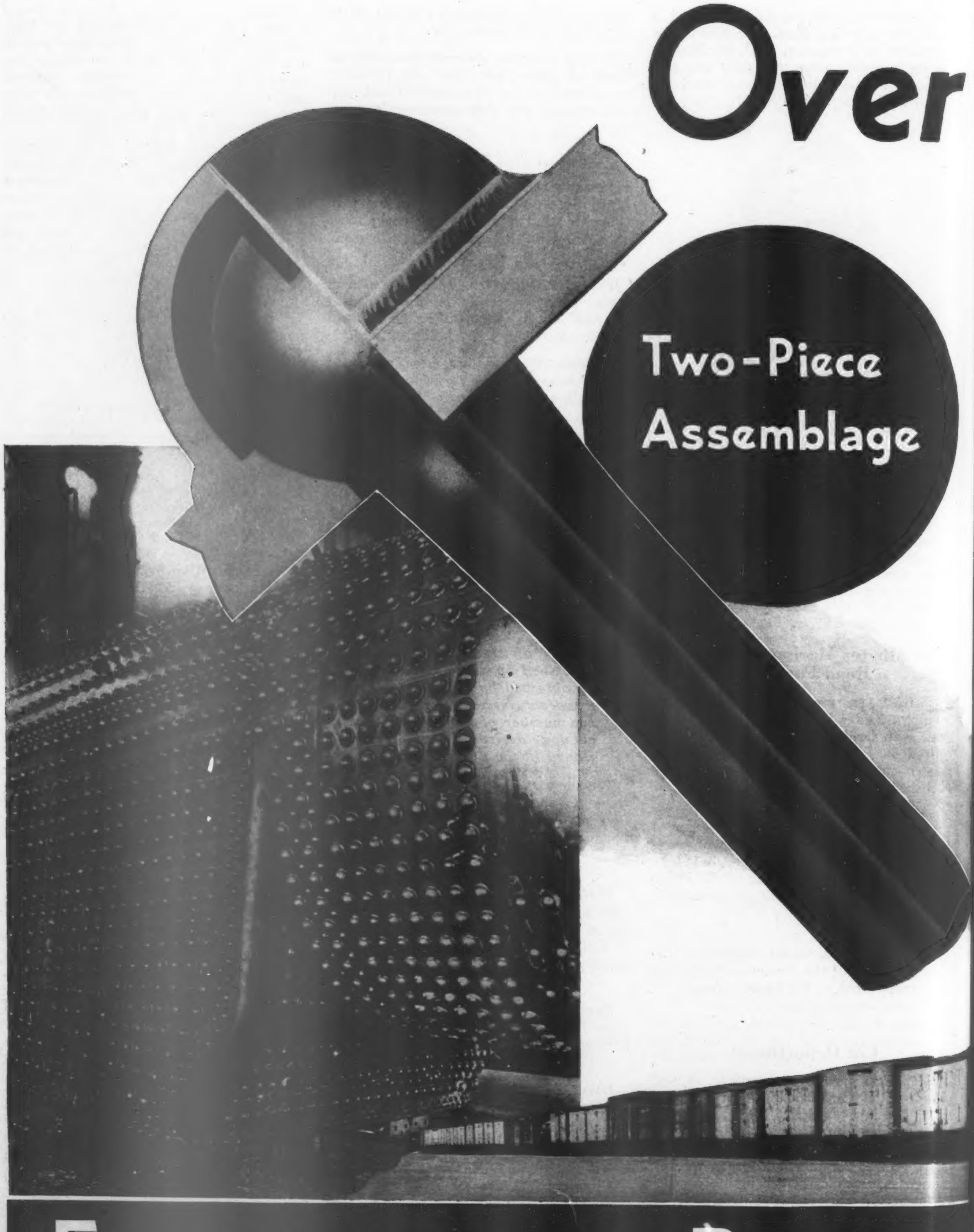
Grey Iron Castings.—The International Nickel Company, Inc., 67 Wall street, New York. Revised data sheet, Section 1, No. 1. Guide to the selection of engineering specifications for grey cast iron, with special reference to sections of various dimensions and tensile strengths of 20,000 to 60,000 lb. per sq. in.

◆

Valves.—Homestead Valve Mfg. Co., Coraopolis, Pa. Reference Book No. 38; 48 pages, illustrated. Features blow-off valves; lift-plug valves, dimensions, tables and facts about Homestead valves, and a new line of semi-steel 500-lb. (oil, water, gas) valves for the oil industry.

◆

Truck Casters and Wheels. — The Fairbanks Company, 393-399 Lafayette street, New York. Catalog 53-44. Standard designs of casters and wheels used by industrial plants, transportation companies, contractors, etc.


Over
Two-Piece Assemblage
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